Dipartimento di Pianificazione Design Tecnologia dell'Architettura

Sapienza Università di Roma

54th SISV Congress

Twenty years in the third millennium with Vegetation Science

September 28th-29th 2021

Abstract book

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The 54th Congress of the Italian Society for vegetation Science was set to be hold in June 2020 at the Faculty of Architecture of the University of Rome. The explosion of the COVID-19 pandemic in the spring of last year led first to move the congress to October 2020 and then definitively to 2021. However, the persistence of the serious situation of COVID-19 infections in Europe during these first months of 2021 and the uncertainty about the results of the current vaccination campaign does not allow us to plan a "face to face" congress as we had planned it.
The SISV 2021 congress will therefore be carried out as a ***virtual conference***.

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Programme

TUESDAY, 28 September 2021

9:00 Welcome and opening remarks

Romeo Di Pietro – Chief organizer of the Congress

Laura Ricci – Director of the Dept. of Planning, Design and Technology of Architecture (PDTA)

Simonetta Bagella – President of the Italian Society of Vegetation Science (SISV)

9.30 1st SESSION ***Vegetation Science and Green infrastructure*** - Chair Riccardo Guarino

9:30 **Blasi C.** Opportunities for vegetation Science in the new European strategies for biodiversity, Farm to fork and Green Infrastructure.

10:00 **Russo A.** Designing biodiverse cities for mental health and wellbeing.

10:15 **Andreucci M.B., Loder A., McGee B., Brajković J., Brown M.** Exploring Regenerative Co-benefits of Biophilic Design for People and the Environment.

10:30 **Gatti L.** Multifunctionality of greening in vegetated buildings: relevant aspects in plant selection.

10:45 **Vannucchi F., Pini R., Bretzel F.** Soil and substrate quality as an opportunity for urban greening and biodiversity conservation.

11:00 **Catalano C., Pasta S., Guarino R.** A plant sociological procedure for the ecological design and enhancement of urban green infrastructure.

11:15 **Ruzzon M., Lipreri E., Armiraglio S.** The green infrastructure role in temperature regulation in the Municipality of Brescia.

11:30 *Break*

11:45 **Round table discussion: *Green infrastructure*** - Coordinator: Riccardo Guarino

Guests:

Maria Beatrice Andreucci - Landscape technology, Sapienza Università di Roma
Stefano Armiraglio - Plant ecology, Museo di Scienze Naturali di Brescia
Carlo Blasi - Plant ecology, Sapienza Università di Roma
Francesca Bretzel - Agrobiology, CNR IRET
Chiara Catalano - Landscape architecture, Zurich University of Applied Sciences
Laura Gatti - Landscape agronomy - freelancer
Adriano Paolella - Architecture technology, Università Mediterranea di Reggio Calabria
Alessio Russo - Landscape architecture, University of Gloucestershire

13:15 *Break*

14:30 2nd SESSION **Forest vegetation** - Chair: Daniele Viciani

14:30 **Burrascano S., Bagella S., Chianucci F., Chiarucci A., Dörfler I., Giordani P., Kepfer-Rojas S., Mitić B., Munzi S., Nagel T.A., Nascimbene J., Paillet Y., Sitzia T., Tinya F., Van der Sluis T., Ódor P.** A European platform of forest multi-taxon biodiversity.

14:50 **Di Pietro R., Viciani D., Angiolini C., Armiraglio S., Caccianiga M., Ciaschetti G., Ercole S., Foggi B., Fortini P., Gabellini A., Gennai M., Gigante D., Selvaggi A., Terzi M., Rosati L.** Floristic and coenological analyses of the *Quercus cerris* forests in Italy.

15:05 **Wellstein C., Burrascano S., Cangelmi G, Cianfaglione K., Chelli S., Filibeck G., LaBella G., Lozano V., Maccherini S., Mugnai M., Tomaselli M., Tomasi D., Rota F., Bonari G.** A clean slate? Effects of the Vaia storm and salvage logging on forest vegetation.

15:20 **Quaranta L., Di Marzio P., Ferretti F., Di Salvatore U., Fortini P.** Analysis of the functional characters of the seedling of *Quercus cerris* L. in Molise Region.

15:35 **Tesei G., Zotti M., Idbella M., Bonanomi G., Ciaschetti G., Allegrezza M.** Distribution and vegetation dynamics of *Pinus mugo* subsp. *mugo* dieback patches in Maiella massif - Central Italy.

15:50 **Mei G., Maccaroni L., Oreskovic M., Taffetani F.** A study on the *Malus florentina* (Zuccagni) C.K. Schneid. populations in the Abbadia di Fiastra (MC) Natural reserve with insight on the main ecological drivers responsible for their current structural pattern.

16:30 *Break*

16:45 Round table discussion: *Forest fires* - Coordinator: Emmanuele Farris

Guests:

Davide Ascoli – Forest Ecology and Management, Università di Torino, Società Italiana di Selvicoltura ed Ecologia Forestale (SISEF)

Romeo Di Pietro - Plant ecology and geobotany, Sapienza Università di Roma

Diego Loi – Mayor of the Municipality of Santulussurgiu (OR) and President of the Union of Municipalities of Montiferru

Giuseppe Marzano - President of Circeo National Park and Forestry Manager of Monti Aurunci Natural Park

Stefano Mazzoleni – Plant Ecology, Università di Napoli Federico II, Comm. Grandi Rischi Prot. civile

Cristina Nadotti – Journalist, Green & Blue, La Repubblica

Pier Paolo Roggero – Agronomy, Università di Sassari

18:15 Poster session

Bertacchi A., Piemonte A. UAV imagery as tool for habitat monitoring in a constantly changing dune environment: the case study of the Tenuta di San Rossore (PI), Tuscany.

Bonini F., Ferri V., Morbidini L., Pauselli M., Valenti B., Vizzari M., Gigante D. Management and enhancement of Apenninic semi-natural grasslands and hay meadows: Action A10 of LIFE "IMAGINE" project.

Della Bella A., Fantinato E., Scarton F., Buffa G. The sustainability of Mediterranean foredune restoration under human disturbance.

Ferri V., Bonini F., Cencini L., Conticelli M., Falcinelli F., Fratoni M., Grohmann D., Maovaz M., Micucci M., Montanucci A., Raggi L., Ratini G., Negri V., Gigante D. The ex-situ conservation of the native flora of European concern in Umbria (central Italy): Action A11 of LIFE "IMAGINE" project.

Gianguzzi L., Caldarella O., Bolpagni R., Lastrucci L. Preliminary insights on the vegetation of the small natural lentic environments of Palermo province (Sicily).

Lazzaro L., Ferretti G., Mugnai M., Bartolini F., Giannini F., Benesperi R. Effects of alien mammals on plant communities on Giglio island (Tuscan Archipelago): insight from the project LETSGO GIGLIO.

Panichella T., Ferrara A., Bricca A., Pennesi R., Tardella F.M., Catorci A. Re-visiting historical seminatural grasslands at Pian Grande di Castelluccio di Norcia to assess patterns of changes in species composition and vegetation cartography update.

Piga G., Caria M.C., Frongia A., Pulina A., Rivieccio G., Roggero P.P., Seddaiu G., Bagella S. Traditional vs adaptive multi- paddock grazing in Mediterranean silvopastoral systems.

Rivieccio G., Gigante D., Bolpagni R., Bonini F., Caria M.C., Cerabolini B.E.L., Dalla Vecchia A., Bagella S. Freshwater habitat recording for strengthening nature conservation: the contribution of Plant Sociology to the UN Agenda 2030.

Sarmati S., Angiolini C., Acosta A.T.R., Barták V., Bertacchi A., Bonari G., Foggi B., Gennai M., Maccherini S., Viciani D., Bazzichetto M. Influence of natural and anthropogenic factors on plant diversity in Mediterranean coastal landscapes: the case of Tuscany.

Viciani D., Lastrucci L. The *Genista radiata*-dominated communities in Italy: diversity and classification.

WEDNESDAY, 29 September 2021

9.00 3rd SESSION **Critical interpretation of EuroVegChecklist with possible new syntaxonomic proposals for the Italian high-rank syntaxa** - Chair: Romeo Di Pietro

9:00 **Theurillat J.-P., Willner W., Fernández-González F., Bültmann H., Čarni A., Gigante D., Mucina L.** About the 4th edition of the International Code of Phytosociological Nomenclature.

9:20 **Alegro A.** Where does Cratonerion belong? An attempt to answer based on the tufa waterfalls in Croatia.

9:40 **Ciaschetti G., Pirone G., Praleskouskaya S., Trivellone V., Venanzoni R.** Mowed meadows of the *Molinio-Arrhenatheretea* class in Central Italy.

10:10 **Poldini L., Tasinazzo S., Vidali M.** Is the current syntaxonomic classification of the sub-Mediterranean oak-hornbeam thermophilos forests able to encompass the high coenological diversity of south-eastern Europe?

10:30 **Terzi M., Di Pietro R., Theurillat J.-P.** Nomenclatural revision for the *Festuco hystricis-Ononidetea striatae* and *Rumici-Astragaletea* siculi in Italy.

11:10 *Break*

11:25 ***Free session*** - Chair: Marco Caccianiga

11:25 **Bricca A., Carranza L.M., Varricchione M., Cutini M., Stanisci A.** Investigating functional diversity and redundancy of Mediterranean high-mountain vegetation types in the Apennines.

11:40 **De Toma A., Carboni M., Bazzichetto M., Malavasi M., Cutini M.** Alpine shrub encroachment in the central Apennines: current patterns and temporal trends.

11:55 **Di Musciano M., Theurillat J. P., Cutini M., Iocchi M., Ricci L., Zannini P., Chiarucci A., Frattaroli A. R.** Pattern and drivers of plant beta diversity along an elevational gradient of Central Apennines – (Italy).

12:10 **Fanfarillo E., Zangari G., Küzmič F., Fiaschi T., Bonari G., Angiolini C.** Surveying roadsides: *Sorghum halepense*-dominated vegetation in peninsular Italy.

12:25 **Gheza G., Di Nuzzo L., Vallese C., Barcella M., Benesperi R., Giordani P., Nascimbene J., Assini S.** Morphological and chemical traits of *Cladonia* lichens respond to vegetation dynamics and other environmental factors in acidic dry grasslands.

12:40 **Mugnai M., Hurtado P., Di Nuzzo L., Balzani P., Frasconi Wendt C., Beltramini A., Ferretti G., Viciani D., Benesperi R., Lazzaro L.** Relationships among vascular plants, mosses and lichens in grasslands communities along elevational gradients.

13:00 *Break*

14:15 4th SESSION ***Critical interpretation and new proposals for the Manual of European Union Habitats*** - Chair: Daniela Gigante

14:15 **Bagella S., Angelini F., Angiolini C., Bonini F., Caccianiga M., De Simone L., Gabellini A., Gigante D., Maccherini S., Rivieccio G., Valle B., Garabini M.** A new challenge from Artificial Intelligence: Robotic European Union habitats monitoring.

14:30 **Sperandii M.G., Bazzichetto M., Malavasi M., Bartàk V., Carboni M., de Bello F., Acosta A.T.R.** Drivers of temporal changes in Mediterranean coastal dune habitats.

14:45 **Pesaresi S., Mancini A., Quattrini G., Casavecchia S.** Remote sensing time series and Functional Principal Component Analysis: a new promising approach for habitats mapping and monitoring.

15:00 **Strumia S., Santangelo A., de Filippo G.** Application of the Directive 92/43/EEC: the Monitoring Plan of the Campania Region.

15:15 **Carli E., Casella L., Cervellini M., Chiarucci A., Angelini P.** Open issues on the identification and effective indicators definition of Habitats.

15:30 **Gangale C., Bernardo L., Uzunov D.** Critical interpretation of habitat 6210 "semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)" in Calabria.

15:45 *Break*

16:00 **Sciandrello S., Cambria S., Crisafulli A., Giusso del Galdo G., Minissale P., Musarella C.M., Puglisi M., Tavilla G., Tomaselli V., Spampinato G.** A new habitat of the shady wet cliffs (*Adiantetea capilli-veneris*) of the Mediterranean region

16:15 **Guarino R., Bazan G., Crisafulli A., Caldarella O., Giusso Del Galdo G., Gristina A.S., La Mantia A., Marcenò C., Minissale P., Pasta S., Sciandrello S., Scuderi L., Spampinato G., Troia A., Gianguzzi L.** Critical interpretation of some Sicilian habitats in the Directive 92/43 EEC and new proposals for for their reappraisal in the Manual of European Union Habitats

16:30 **Spampinato G., Tomaselli V., Forte L., Strumia S., Stinca A., Croce A., Fascetti S., Rosati L., Di Pietro R., Laface V.L.A., Musarella C.M.** Need for a revision of the habitats listed in Directive 92/43 EEC to safeguard the biodiversity of southern Italy

16:45 **Casavecchia S., Ciaschetti G., Gigante D., Viciani D., Allegrezza M.** Proposal for additions to Annex I of Directive 92/43/EEC with new habitats worthy of conservation for central Italy

17:00 **Bagella S., Bacchetta G., Caria M.C., Cogoni D., Farris E., Fenu G., Fois M., Manca M., Pinna S., Pisanu S., Rivieccio G.** Neglected vegetation in Sardinia: what possibilities to be considered in Annex I of the Habitats Directive?

17:45 **Closing the 54th SISV Congress**

18:00 **SISV Business Meeting**

Vegetation Science and Green infrastructure

Opportunities for vegetation Science in the new European 'Biodiversity', 'Farm to fork' and 'Green Infrastructure' strategies

Blasi C.
Prof. Emeritus - Scientific Director of the Interuniversity Research Center "Biodiversity, Ecosystem Services and Sustainability" (CIRBISES). Sapienza University of Rome

Presenting author: Carlo Blasi, carlo.blasi@uniroma1.it

The missions of the Next Generation Eu and the National Recovery and Resilience Plan (NRRP) on the protection and recovery of biodiversity keep in mind both the need for agriculture heedful of the functionality of ecosystems and the need to increase nature in cities. In all this it is clear the significant presence of phytosociologists and plant ecologists.

The red list of ecosystems in Italy has clearly underlined the situation of our country's natural capital. Although there are not many situations close to collapse (apart from the situation of glaciers and some coastal situations) there are many vulnerable or threatened ecosystems for which recovery actions should be started. The pandemic has also clearly highlighted how in some ecoregions of Italy it is needed to expedite policies that promote restoration ecology actions for which floristic and vegetational knowledge are crucial.

It 'worth noting how at the European level the Biodiversity and Farm to fork Strategies set common goals such as the protection of biodiversity, the recovery of 27,000 kilometres of waterways and the planting of 3 billion autochthonous trees over the next 10 years to bring more nature back to cities and to intensive agricultural systems. The "Farm to fork" and "Biodiversity 2030" strategies presented last May 21 in Brussels are the first real attempt at an integrated agri-food policy. This positive event is consistent with the Green Deal and promotes the idea that food, environment, health and agriculture are closely related issues.

To do this, it is needful to know the actual vegetation, the vegetational potential and the ecosystem services to be placed at the base of territorial planning. It is no coincidence that the "Green Infrastructure Strategy" places the recognition of the "demand" for ecosystem services as the starting point of territorial planning.

At national level there are two Committees at the Ministry of Ecological Transition that deal with natural capital and public green areas (with particular attention to urban green areas). In recent years they have promoted policies that led to project for which the integration with other professional duties is prerequisite. Particular attention was paid to those projects dedicated to metropolitan cities aimed at improving air quality and mitigating the climate crisis through the planting of new urban forests of local native species.

Finally, the progress in the field of national ecological maps (climate, vegetation, ecoregions, ecosystems, landscape, biogeography) should be underlined since these maps are especially useful to apply the new European Strategies and to optimize the opportunities offered by the NRRP projects and, more generally, by the environmental, agricultural and infrastructural sectors.

Designing Biodiverse Cities for Mental Health and Wellbeing

Russo A.
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Presenting author: Alessio Russo, arusso@glos.ac.uk

Following the Brundtland Report in the early 1990s, the relationship between biodiversity and human wellbeing became a topic of public debate and scientific research [1]. Nowadays, biodiverse cities can provide ecosystem services as well as mental health and wellbeing. Biodiverse cities have a critical role in delivering services and infrastructure, addressing inequity, and regulating environments that influence human health [2]. Several urban health issues may be handled with adequate planning and resources, resulting in mutual advantages for human and environmental health [2]. However, the health effects of biodiversity loss are becoming more well recognised. Ecosystem functioning is affected by biodiversity changes, and substantial ecosystem disturbances can result in life-sustaining ecosystem goods and services [3]. As a result, initiatives for increasing and conserving biodiversity in cities are required. This research examines case studies of urban green infrastructure, best practices, and policies in the United Kingdom and the United States that enhance human health, well-being, and biodiversity conservation.

1) Naeem, S.; Chazdon, R.; Duffy, J.E.; Prager, C.; Worm, B. Biodiversity and human well-being: an essential link for sustainable development. Proc. R. Soc. B Biol. Sci. 2016, 283, 20162091.
2) Secretariat of the Convention on Biological Diversity Cities and Biodiversity Outlook—Executive Summary; Montreal, 2012; ISBN 9292254375.
3) WHO Biodiversity and Health Available online: https://www.who.int/news-room/fact-sheets/detail/biodiversity-and-health (accessed on Aug 5, 2021).

Exploring Regenerative Co-benefits of Biophilic Design for People and the Environment

Andreucci M.B.[1], Loder A.[2], McGee B.[3], Brajković J.[4], Brown M.[5]

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Presenting author: Maria Beatrice Andreucci, mbeatrice.andreucci@uniroma1.it

Integrating nature into our cities, and more recently, our buildings, has long been associated with improved environmental and health outcomes. The recent Covid-19 pandemic has also thrown into sharp relief the role that buildings, districts and neighbourhoods play in human health: both from location - those living in areas with worse air pollution have been shown to have a higher death rate from Covid-19 [1] - and from amenities. For example, the role of urban parks in stress reduction and socialization has renewed attention on the benefits of nature, both in and outside buildings [2].

However, despite long-standing research on the benefit of access to nature for human and climate health, there is still uncertainty in the sustainability and design fields on exactly what types of nature can lead to which types of benefit, and for whom. Uncertainty is partly rooted in a failure to understand how to understand and apply research on nature and health to different design and policy interventions at different scales. Issues arise also from a disconnection between biophilic design principles and specific health outcomes, as well as from a lack of integration between different fields. This is particularly true as buildings, cities, and regions attempt to align regenerative design goals with human health ones, but often lack the tools and knowledge to do so.

This contribution outlines key research paradigms that influence the way we understand the benefits of nature for different sectors, including the workplace, neighbourhood, and city, and explains where biophilic design theory sits in this field. A brief explanation of the key driving beliefs and goals of the most influential research on health and nature, key known outcomes, and how and where they can be used to support the integration of nature into buildings, communities, and cities to support human and ecological health is provided.

This is followed by a discussion about how this research aligns, or does not align, with architectural and urban design. Through case studies at the building and city scale, this contribution then examines how biophilic design can be applied, and highlights lessons learned, synergies and trade-offs when implementing nature for both human and ecological health.

The contribution ends with key policy and design lessons learned around regenerative design and biophilia, as well as with the indication of new directions for action, particularly with regards to climate change and infectious disease.

1) Wu X., Nethery R.C., Sabath B.M., Braun D. and Dominici, F., 2020. Exposure to air pollution and COVID-19 mortality in the United States. https://projects.iq.harvard.edu/covid-pm?gsBNFDNDN=undefined&utm_campaign=wp_the_energy_202&utm_medium=email&utm_source=newsletter&wpisrc=nl_energy202. Accessed 12 May 2020.

2) Surico J., 2020. The Power of Parks in a Pandemic. June 22nd [Video]. https://www.bloomberg.com/news/articles/2020-04-09/in-a-pandemic-the-parks-are-keeping-us-alive Accessed 23 June 2020.

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Multifunctionality of greening in vegetated buildings: relevant aspects in plant selection

Gatti L.
Founder Studio Laura Gatti
Adjunct Professor Department of Agricultural and Environmental Sciences - Production, Landscape, Agroenergy Università degli Studi di Milano.

Presenting author: Laura Gatti

Outdoor and indoor urban landscapes, buildings, streetscapes are all seen as opportunities for nature to provide ecosystem services as stormwater management, wastewater treatment, food production, microclimate moderation. This approach allows us access to nature and recreation, support biologically diverse ecosystems and protects these assets for future generations. Plants grow everywhere, softening the hardness of the urban environment. The urban forest draws carbon from the atmosphere and stores it as wood. Vegetation flows through the city, supporting ecosystems that allow human residents can interact with wildness daily.

Roof spaces and building walls can be seen to promote vertical and horizontal green infrastructure, expanding vegetation cover in the urban area. Vegetated buildings, covered by living roofs and walls, establish a new relationship between Nature and Cities. Opportunities to bring natural elements into the built environment are becoming a trend in contemporary architecture.

Environmental constraints, including water availability, substrate composition, and micro-climatic influences, are currently a critical source of limiting factors that, in most locations, must be still clarified. The immediate solution is to declinate traditional gardening techniques, but this is not sufficient.

The time has come to find a new interaction overcoming the concept of luxury and developing solutions that can also be applied in disadvantaged areas, realizing at the same time an improvement of consciousness about climate crisis and opportunities to increase social connections. Beyond the landscape concept, the plant selection criteria could not be based only on aesthetics value but must consider the particular conditions of cultivation. The point is to understand if the same process we observe in nature can be replicated in the built environment and applied to buildings.

SOIL AND SUBSTRATE QUALITY AS AN OPPORTUNITY FOR URBAN GREENING AND BIODIVERSITY CONSERVATION

Vannucchi F.[1], Pini R.[1], Bretzel F.[1]
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Presenting author: Francesca Bretzel, francesca.bretzel@cnr.it

Soil is a key component of the water and nutrient cycle and a major contributor to global carbon sequestration. It can remediate pollution and provides habitat for almost all land plants, as well as a large proportion of terrestrial fauna. Yet despite its global importance, it is estimated that one third of global soil is degraded. In urban environments, soil is often overlooked despite its potential to alleviate problems such as flash flooding and its vital role in supporting vegetation, which also contributes to the urban landscape by, for example, reducing the Urban Heat Island. Because of the changing nature of the city, soils undergo many disturbance actions: manipulation, compaction, and pollution for example. These degrade its important properties leading to loss of fertility and function. Low-nutrient soils are, however, a potentially valuable resource for the creation of species rich native vegetation, as the most biodiverse herbaceous vegetation is often found on these soils. Where habitats in cities are being created, for example in the case of extensive green roofs, there is research to be done in developing soils that meet the economic and engineering needs of industry, while functioning as a successful habitat.

A plant sociological procedure for the ecological design and enhancement of Urban Green Infrastructure

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Presenting author: Chiara Catalano, cata@zhaw.ch

Urban Green Infrastructure could represent an important mean for environmental mitigation, if designed according to the principles of restoration ecology. Moreover, if suitably executed, managed and sized, they may be assimilated to meta-populations of natural habitats, deserving to be included in the biodiversity monitoring networks. In this chapter, we combined automatized and expert opinion-based procedures in order to select the vascular plant assemblages to populate different microhabitats (differing in terms of light and moisture) co-occurring on an existing green roof in Zurich (Switzerland). Our results lead to identify three main plant species groups, which prove to be the most suitable for the target roof. These guilds belong to mesoxeric perennial grasslands (Festuco-Brometea), nitrophilous ephemeral communities (Stellarietea mediae) and drought-tolerant pioneer species linked to nutrient-poor soils (Koelerio-Corynephoretea). Some ruderal and stress-tolerant species referred to the class Artemisietea vulgaris appear to fit well with local roof characteristics, too. Inspired by plant sociology, this method also considers conservation issues, analysing whether the plants selected through our procedure were characteristic of habitats of conservation interest according to Swiss and European laws and directives. Selecting plant species with different life cycles and life traits may lead to higher plant species-richness, which in turn may improve the functional complexity and the ecosystem services provided by green roofs and green infrastructure in general.

The green infrastructure role in temperature regulation in the Municipality of Brescia

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Municipality of Brescia - Museum of Natural Sciences, Via Ozanam 4, Brescia, (Italy).

Presenting author:

With more than half of the world's population living in cities, the ecosystem services that green areas in urban centers can offer to improve citizens' well-being are increasingly important, in particular their ability to mitigate the "heat island effect," of soiled surfaces through the evapotranspiration of plants, making green areas" urban cooling islands ". In this paper, starting from a series of satellite images showing the temperature at ground level, the urban heat island phenomenon in the Municipality of Brescia and the effectiveness of some green areas in mitigating are assessed. These mitigating effects occur in the summer, during the vegetative activity of the plants, while during the winter season, with the vegetative rest, the effects are completely irrelevant. The extent of the mitigation capacity varies with changes in land consumption, and decreases from wooded and semi-natural areas, to agricultural areas and to urban green areas. Regardless of their surface, these regulation areas have a range of influence that also extends to the surrounding built areas, while the mitigation capacity is generally reduced in proportion to the size of the area itself, but also to the heterogeneity of the areas surrounding these areas. The results assess for the first time the extent of the "heat island" phenomenon in the Municipality of Brescia, and underline the importance that the considered green areas have in mitigating the temperatures of the city.

Forest vegetation

A European platform of forest multi-taxon biodiversity

Burrascano S.[1], Bagella S.[2], Chianucci F.[3], Chiarucci A.[4], Dörfler I.[5], Giordani P.[6], Kepfer-Rojas S.[7], Mitić B.[8], Munzi S.[9-10], Nagel T.A.[11], Nascimbene J.[4], Paillet Y.[12], Sitzia T.[13], Tinya F.[14], Van der Sluis T.[15], Ódor P.[14]

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Forests cover almost 40% of the European Union territory [1], and, with 75 forest types [2] and 81 habitats (Directive 43/92/CE), are crucial for the conservation of biodiversity in Europe. However, only 24% of European forests are protected [1], and 0.7% of them are primary forests [3].

These figures underline why the maintenance of forest biodiversity in the European Union is based on the concept of sustainable forest management (SFM). Despite this, about 80% of the forest habitat types are in an unfavourable conservation status, and forest management is reported as their main pressure [4].

The existing SFM indicators for the biodiversity sustainability of forest management either account only for trees, or are indirect biodiversity proxies, often not tested or vaguely defined. This crucial gap stems from the lack of broad scale forest biodiversity data, with multi-taxon biodiversity usually not sampled during national forest inventories due to money and time constraints.

Recently, several groups of scientists from research institutions across Europe took up the challenge of multi-taxon field sampling through local or regional projects aimed at understanding the effects of forest management on overall ecosystem biodiversity. The COST Action BOTTOMS-UP collects multi-taxon data to build a comprehensive platform of European forest biodiversity. Up to now, we standardized and merged 35 different datasets encompassing 3,858 plots across 13 forest categories [2] and 13 European countries. For each plot, information on at least three taxonomic groups are available, besides spatial coordinates, individual tree measures, and information on forest management. The aim of the project is to test the effects of different management regimes on several taxonomic groups, and to identify direct biodiversity indicators of management sustainability.

The project preliminary results are a synthesis of the sampling approaches of forest multi-taxon studies, and an overview of the forest multi-taxon information available in Europe. The platform should become an overall stimulus for vegetation scientists towards cross-taxon collaborations to understand the links between vegetation and habitat types, and patterns of multi-taxon biodiversity.

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Floristic and coenological analyses of the *Quercus cerris* forests in Italy

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Quercus cerris forests represent an important part of the forest heritage of the Italian peninsula. They show a wide distribution especially within the Apennines, from the sea level to the lower montane belt, while they are much rarer in northern Italy [1]. According to a recent nomenclatural paper [2], there are 39 validly published associations of "*Quercetum cerridis"* described for Italy at present. The EuroVegChecklist [3] encompasses the Italian *Quercus cerris* forests within two classes, three orders and eight alliances while the Prodrome of Italian vegetation [4] within one class, two orders and nine alliances. In our research, we compiled and stored the most ever comprehensive database regarding *Quercus cerris* dominated forest in Italy. This included 2900 relevès of which 64% published and 36% deriving from unpublished data from the authors of this paper. The whole data set treated with multivariate analysis procedures displayed the occurrence of nine major clusters. Considering the geographic provenance of the relevés and their distribution in these nine clusters only a partial correspondence with the current major syntaxonomic frameworks emerged. Floristic analysis allowed us to clearly distinguish i) thermophilous woods with a Tyrrhenian distribution, ii) acidophilous woods, iii) neutro-basiphilous submontane central Apennines woods, iv) montane woods of the central and southern Apennines. Together with these well-identifiable clusters there are others which do not exhibit differential species having ecological or biogeographical diagnostic power. It should be noted that relevés (coming from different phytosociological tables and sometimes from single ones) originally assigned to a given association not necessarily group in the same cluster but result frequently scattered in numerous of them (up to seven). This suggests that, besides proposing new and more accurate syntaxonomic frameworks that classify forest vegetation up to the alliance or (at the most) sub-alliance level, greater attention should be paid to the floristic, ecological and biogeographical consistence of the associations. "Association" is the only syntaxonomic rank related to a real object directly identifiable in the field, strictly corresponding to the concept of "plant community", and probably the only one through which a phytosociologist can make him/herself understood when sharing field-work and data interpretation with colleagues of related disciplines, such as forestry, landscape ecology and others.

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A clean slate? Effects of the Vaia storm and salvage logging on forest vegetation

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Natural and anthropogenic disturbances are key factors in forest vegetation dynamics. Forest disturbance regimes are rapidly changing, with increasing magnitude and frequency of extreme events such as pathogen invasions, wildfires and windstorms, possibly as a consequence of climate change [1]. In October 2018, the "Vaia" storm hit the Eastern Italian Alps and destroyed or intensely damaged ca. 42.500 ha of forest with a volume estimation of 8.5 millions m^3 of fallen trees [2]. These montane and subalpine forests, which have been managed for hundreds of years, are usually dominated by *Picea abies*, often derived from old plantations. In summer 2021, the field workshop of the "Gruppo di lavoro per l'Ecologia della Società Botanica Italiana (SBI)" collected data about the vegetation succession and the effects of management practices on forest vegetation after the Vaia storm in the Trento province (IT). We selected four sites, including three treatments at each site: undisturbed forest, storm-disturbed forest with salvage logging and storm-disturbed forest without salvage logging. For each treatment, we randomly selected and sampled three plots of 50 m^2, obtaining a total of 36 georeferenced sampling units (4 sites × 3 treatments × 3 plots). Topographic variables (aspect, slope and altitude) were recorded along with information on the cover of rocks, bare soil, deadwood and different components of vegetation such as shrubs, forbs, grasses, ferns and mosses. We assessed forest structure by measuring standing trees and deadwood. We recorded all the vascular plant species occurring in the sampling units. For each species the percentage cover was assessed. Seedlings and juveniles of woody species were also counted. We compared the rarefaction curves of the three treatments at all sites by means of the iNEXT package using the Hill number framework. We also compared the number of seedlings and juveniles as well as their species richness. Overall, we found 191 species (on average 26 in undisturbed forest, 33 in storm-disturbed forest with salvage logging, and 30 in storm-disturbed forest without salvage logging). An attempt was also made to interpret the evidence relating to the distance between actual and potential vegetation. Our preliminary results show that plant diversity increased in the disturbed areas, with a greater increase in salvaged areas. The number of seedlings and juveniles do not differ among treatments, while weak differences exist in terms of the number of tree species occurring in the regeneration. Our approach contributes to elucidating the short-term effects of the Vaia storm on forest vegetation and will feed the debate on management practices, for example the usefulness of salvage logging for forest vegetation recovery, to be applied in future extreme windstorms.

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Analysis of the functional characters of the seedling of *Quercus cerris* L. in Molise Region

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This study aims to investigate which are the best forest management conditions of the *Quercus cerris* L. woods for the growth and development of new seedlings to ensure a good renewal of the forest over time. The study was conducted in Molise region in three woods named Bosco di San Leo, Bosco della Ficora and Selva di Castiglione. The three sampling sites can be considered homogeneous from a phytoclimatic point of view but of three different phases of the same silvicultural system. The three populations are distinguished by: age (135-55-90 years), altitude (810-920-1000 m), exposure (NW-NNW-SW), slope (35% -15% -0%), lithology (arenaceous-pelitic, arenaceous-pelitic, varicolored clays). The experimental approach involved: a) Floristic and Phytosociological sampling; b) the collection of thirty 3-4 year old seedlings per site, on which the following parameters were analysed: i) phenotypic characteristics of the seedlings (roots, stem and leaves); ii) five plant functional traits - PFTs (Specific Leaf Area - SLA, Leaf Dry Matter Content - LDMC, Leaf Mass Per Area - LMA, Leaf Water Content - LWC, Leaf thickness - Lth); iii) Green index (Normalized Difference Vegetation Index - NDVI); iv) Chlorophyll content; v) two soil measurements (bulk density and pH). The PFTs were observed and analysed following the standardized protocols regarding their collection, analysis and data processing [1], adapting them to the seedlings of woody species.

The results show that all the sampled woods belong to the association *Roso arvensis-Quercetum cerridis* Ubaldi 2003 (originally assigned to *Aremonio agrimonioidis-Quercetum cerridis* Blasi et al. 2005 ex Terzi et al. 2020) [2-4]. Regarding the PFTs measured, ALS, LWC, Chlorophyll Content and NDVI were positively correlated with seedling growth while LDMC, LMA, LTH were negatively correlated. The wood of Selva di Castiglione is the one that exhibited the highest values for the aforementioned parameters. Although the three different woods investigated show different values for the PFT analysed due to their different environmental conditions, they exhibit a similar phenotypic response. It means that the degree of phenotypic plasticity (i.e. the ability of an organism to express different phenotypes in different environments) of *Quercus cerris* in the study area is to be considered as neutral (i.e. environmental differences don't affect physical fitness) [5], at least as far as 3-4 years old seedlings are concerned.

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Distribution and vegetation dynamics of *Pinus mugo* subsp. *mugo* dieback patches in Maiella massif - Central Italy

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Forest dieback in the last decade has been reported all over the world. The causes of dieback are complex and include the interaction of abiotic factors with insect outbreak and soilborne pathogens. Patch dieback not only causes a significant loss of forest yield but also affects successional trajectories. Some authors observed the presence of dieback patches in *P. mugo* stands in the Maiella massif, but no studies examined the underlying causes as well as the ecosystem impacts.

In this study, we investigate the distribution, size and shape of *P. mugo* dieback patches in Maiella massif and how they affect the vegetation dynamics.

Dieback patches were identified for their size, elevation, and occurrence in relation to mountain side exposition and slope by using satellite images. According to dieback patch size, we identified three ontogenetic stages: small patches with lacking inner regeneration of *P. mugo*, medium and large. To assess the effect of *P. mugo* on co-existing species each patch was divided into four belts according to *P. mugo* healthy status: OUT area, undisturbed *P. mugo* community; FRONT belt, with dying *P. mugo*; DEAD belt, with the presence of death *P. mugo*; IN zone only for medium and large dieback patches, characterized by *P. mugo* recruitment. Within the four belt zones in two randomly selected *P. mugo* dieback patches for each of the three ontogenetic stages, a vegetation analysis was conducted for a total of 69 plot-relevees.

Overall, 35 dieback patches were recored mainly distributed on the eastern and northern side in the Maiella massif. The dieback patches have diameters ranging from a few meters to a maximum of 76.1 m. The width of IN belt was linearly correlated with patch diameter. Regarding the topography, the 42.8% of the cases were in the range between 41% and 60% of slope. Species diversity associated with *P. mugo* dieback patches showed a similar trend in relation to belt type and ontogenetic stages, being higher in the DEAD belt with the lowest values recorded in the OUT area, except for large patches where species diversity was highest in the FRONT. Also life forms of species associated with dieback patches showed a similar trend in relation to belt type and ontogenetic stages with hemicryptophytes that dominated DEAD and FRONT belts and phanerophytes with the highest cover in OUT and IN belts for all of the three ontogenetic stages. At the plant community level, a clear separation was observed for the four belt: OUT belt where there were relatively heliophilous, microthermal and basophilous species together with a good contingent of nemoral species typical of *Fagus sylvatica* forests; FRONT belt with heliophilous herbaceous species; DEAD belts with several perennial grass and forb belong to different ecology; IN belt with ecotonal species and several grassland species, although less abundant compared to DEAD belt and.

This finding is important in understanding the potential ecological impacts of dieback disturbance in high elevation forest ecosystems. Dieback patches are notable features of mountain ecosystems, and their dynamic nature likely plays an important role in maintaining biodiversity by allowing alternation between forest and grassland ecosystems. In this respect, the death of established vegetation allows the periodic flourishing of life through ecosystem rejuvenation. Future studies are needed to identify the causes of dieback and their temporal dynamics using a dendroconological approach.

A study on the *Malus florentina* (Zuccagni) C.K. Schneid. populations in the Abbadia di Fiastra (MC) Natural reserve with insight on the main ecological drivers responsible for their current structural pattern

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Malus fiorentina is a tree-shrub species with a north-east-Mediterranean distribution, exclusive to central-southern Italy, the southern Balkans and northern Greece [1,2]. Although reported for Italy throughout the peninsular area, where it grows in sub-Mediterranean forests, the species is sporadic and very rare [1,3]. The presence of *M. florentina* in the territory of the Marche region is historically known for the forest areas of Monte Cerignone (PU), San Nicola (PU), Montebello (PU), Gallignano (AN) and Abbadia di Fiastra (MC) [1,4]. The first data of the study started in 2017 by the Polytechnic University of Marche in collaboration with the Department of Forestry and Applied Ecology of the University of Zagreb, as well as highlighting how the species not following the expansion trend of forest areas recorded on the regional [5] and national territory [6], but on the contrary it appears in regression also in the historically areas were its presence is known. The study has also made possible to locate in the forests of the Abbadia di Fiastra Nature Reserve the most numerous population at the regional level. This population was therefore interested by a series of phytosociological, silvicultural and pedological surveys aimed at characterizing the vegetational aspects of the area in question and defining its environmental parameters and the main ecological drivers responsible for the presence and development of the population. Preliminary results of the data analysis, which are here presented, revealing the close correlation between qualitative and quantitative characteristics of the population with forest management, structural and pedological complexity of the areas under examination, highlighting how the population of *M. florentina* is in regression where the coverage of the crowns of the dominant floor is compact and uninterrupted both spatially and temporally. Data analysis also identifies the areas subject to conversion in high forest by natural evolution or active elimination of the dominated layer due to thinning operations by positive selection, as the most affected by population reduction. The situation that emerges is therefore paradoxical since it highlights a potential threat to the conservation of biodiversity, both locally and territorially, triggered to operations aimed at naturalistic protection actively financed.

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Poster session

UAV IMAGERY AS TOOL FOR HABITAT MONITORING IN A CONSTANTLY CHANGING DUNE ENVIRONMENT: THE CASE STUDY OF THE TENUTA DI SAN ROSSORE (PI), TUSCANY

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Preliminary results related to the use of UAV technology for monitoring coastal erosive dynamics and effects on dune habitats (sensu 92/43/EEC directive) are reported.

The investigated coastline (San Rossore Estate, part of the M.SR.M.Regional Park) in the north-west of Tuscany is one of the coastal sectors of Tuscany most affected by coastal erosion. Since 1954 to present, with a range that goes from a minimum of 10 m to a maximum of 382 m of coastal retreat, erosion has determined and determines constant readjustments or, often, disappearance of the dune habitats. In spite of this, the sandy coast still reveals the presence of the most significant dune habitats, although discontinuous, fragmented and often altered in their floristic-vegetational physiognomy [1]. The belt relative to entire foredune system including the 1210, 2110 and, in part, 2120 habitats, has been and it is still subject to erosive processes while the fixed dune, in part, still remains.

In this context, as part of ongoing research into coastal line surveying methods, implemented by A.S.T.R.O. laboratory of the Civil and Industrial Engineering Department of the University of Pisa, UAV high definition images (0.45 cm/px, flight alt.20 m) were taken in order to test a quick monitoring on georeferenced plots, located on the N and S of the mouth of the Morto Nuovo River. Here, the north sector is completely eroded while the south sector undergoes a process of erosion and redeployment of sediments. On two series of flights (2016-2019) carried out in the area, 6 adjacent- plot transects, orthogonal to the coast line, were highlighted on the UAV imagery. Afterwards, phytosociological surveys were carried out on the ground and compared with what is identified by manual and semi-automatic interpretation of imagery on GIS platform.

Together with the partial collapse of the dune system due to erosion, it detects an impressive coverage of *Euphorbia paralias* that actually extends from the edge of the annual vegetation of drift lines (H1210) to the foot of the partially consolidated dune (H2210) that still survived erosion.

From what has been pointed out so far, some considerations can be drawn : 1- the use of high definition UAV imagery, with appropriate software, allow a very accurate recognition of the main species / communities, not unlike that on the ground and highly accurate coverage measurement; 2- where the erosive process is continuous and progressive, there is the disappearance of habitats and a partial translocation of some species towards the interior; where a dynamics of erosion and partial redeployment of sand insists, the rarefaction/disappearance of diagnostic species of H2110 (i.e *Elymus farctus*) the rarefaction of diagnostic species of H2120 (i.e *Ammophila arenaria*) and the massive expansion of semi-monophytic communities of other diagnostic species of innermost dunes H2120 (i.e *Euphorbia paralias*) is observed. In this case, *Euphorbia paralias* coverage, could be used as an “early warning” of degradation of habitat.

This case study reveals that monitoring with UAVs can be of great help to the survey in the field, being able to quickly record the entire spatial context where to have the possibility to detect innumerable survey plots, at a later time. The high resolution orthophotos, in these environments, can provide an excellent habitat identification tool and detection of some target species (typical-diagnostic-characteristic).

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MANAGEMENT AND ENHANCEMENT OFAPENNINIC SEMI-NATURAL GRASSLANDS AND HAY MEADOWS: ACTION A10 OF LIFE "IMAGINE" PROJECT

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The LIFE IMAGINE (IPE/IT/000015) is an Integrated LIFE Project that aims to support the development of an integrated, unified, coordinated, and participatory management strategy for the Natura 2000 network in the Umbria region (www.lifeimagine.eu).

The preliminary action A10, which is currently in progress in the first two of the seven years of the project (2020-2027), consists of "Development of Action Plans and associated management techniques of target Annex I habitats and Annex II-IV plant species in grazed systems" and focuses on Annex I Habitats H6110*, H6210(*), H6220*, H6230*, H6510, and on the biologic habitats of *Himantoglossum adriaticum* H.Baumann, *Iris marsica* I.Ricci & Colas., *Ionopsidium savianum* (Caruel) Ball ex Arcang., **Klasea lycopifolia* (Vill.) Á.Löve & D.Löve, i.e. the species of Annex II-IV related to grazed systems occurring in Umbria.

These semi-natural habitats are seriously threatened by changes in the land use, that in the past ensured their maintenance, due to progressive abandonment of agro-pastoral practices (extensive grazing and mowing), and consequent recovery of the dynamism of vegetation (recolonization by tall grasses, shrubs, and tree species), causing a structural, functional and floristic-phytocoenotical transformation, eventually leading to the habitats' loss.

These phenomena are already reality in large sectors of the Apennines, and in Umbria as well. In order to ensure the survival of these biodiversity-rich habitats, it is necessary to develop scientifically valid, innovative, sustainable management models that integrate both the conservation aspects and the zootechnical-productive priorities of the livestock farms. The latter might thus actively participate in the protection and enhancement of the biodiversity of the Apennine pastoral ecosystems.

In this frame, Action A10 is intent to: 1) investigate target Annex I habitats and the biologic habitats of Annex II-IV target plant species in grazed systems in order to provide i) a punctual identification of "Graze-Sites" where the actions will be put into practice, ii) the phytocoenotic characterization of the 4 Annex II-IV target plant species in all their sites of occurrence, iii) the floristic/vegetational composition, structural and functional traits and current distribution of the 5 Annex I habitats in the "Graze-sites"; iv) the distribution and floristic/vegetational composition of the surfaces affected by natural dynamics resulting from the abandonment of traditional practices; 2) analyze the animal production systems; 3) develop spatial models for the analysis of grassland productivity over time and space; 4) design innovative Web-GIS tools for grazing systems, based on vegetation analysis and satellite indices; 5) draw up "Biodiversity-focused" Grazing and Mowing Plans, aimed at a sustainable extensive use of grasslands and meadows in order to improve their conservation status, based on the application of an appropriate animal load consistent with the floristic-vegetational characteristics of the target habitats, and 6) draw up, based on the results of previous points, specific Action Plans for the areas most affected by threats/pressures, especially due to the occurrence of successional processes as a result of the abandonment of traditional practices.

These preliminary activities are currently in progress and the first results are here proposed. They will be followed by practical applications in the second phase of the Project. Among the developed tools, particular efforts will be devoted to strengthening the economical sustainability of the mountain economy and to promote the products of the zootechnical activities.

THE SUSTAINABILITY OF MEDITERRANEAN FOREDUNE RESTORATION UNDER HUMAN DISTURBANCE

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During the last decades, human activities have deeply altered the dynamic equilibrium which characterises coastal dune ecosystems, by leading to coastal dune loss and degradation [1]. Nowadays, one of the biggest challenges in dune restoration is to determine the feasibility and efficacy of restoration actions in areas where dunes are under persisting human disturbance. We evaluated the efficacy of Mediterranean foredune restoration along the North Adriatic coast (Italy) in dune areas freely accessible to tourists. Foredunes were reconstructed through sand accumulation and subsequently consolidated through the plantation of seedlings of focal species. We monitored transplanted and spontaneous seedlings for one year and we assessed their growth and mortality in relation to the distance from the closest beach access as proxy of human disturbance. Furthermore, we tested whether species differing in their ecology (i.e., affinity to a given habitat) and growth form showed different response to human disturbance. We found a clear spatial pattern of seedling survival and growth, which decreased as the proximity to the closest beach access increased. Only invasive alien plants and erect leafy species showed to better perform at intermediate levels of human disturbance, possibly due to their capability to rapidly respond to disturbance events [2] and their spiny leaves, which can act as a deterrent to people [3]. In the present study, we showed that foredune restoration should incorporate human disturbance as input necessary for the sustainability of restoration over time. Limiting trampling damage through fences and boardwalks have been proved to be a highly efficient management measure [4]. However, from a restoration perspective, planning seedling transplantation according to their traits can contribute to improve restoration efficacy, making more resources available for the implementation of complementary activities aimed at preventing human disturbance and promoting a more environmentally oriented tourism development.

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THE *EX-SITU* CONSERVATION OF THE NATIVE FLORA OF EUROPEAN CONCERN IN UMBRIA (CENTRAL ITALY): ACTION A11 OF LIFE "IMAGINE" PROJECT

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In October 2020, the LIFE Integrated Project "IMAGINE" (LIFE19 IPE/IT/000015) started, structured in a preliminary (2020-2022) and an applicative (2022-2027) stage. Its general aim is that of supporting the development of an integrated, unified, coordinated, and participatory management strategy for the Natura 2000 network in the Umbria region (www.lifeimagine.eu). Among the preliminary actions, A11 is focused on the "Development of action plans and *ex-situ* conservation protocols for 5 Annex II-IV plant species" occurring in Umbria. These are, specifically: *Adonis distorta* Ten., *Himantoglossum adriaticum* H. Baumann, *Iris marsica* I. Ricci & Colas., *Ionopsidium savianum* (Caruel) Ball ex Arcang., **Klasea lycopifolia* (Vill.) Á. Löve & D. Löve, the latter with priority importance according to the Council Directive 92/43/EEC. The same Directive imposes to each EU country, and related management bodies, the responsibility of maintaining all these species in good conservation status.

On these grounds, the Action A11 of the Project is devoted to developing specific Action Plans for the correct management of the 5 target species and their populations in Umbria, based on a complete overview of their ecology, distribution, demography, biological habitats, and floristic-vegetational traits. Another important target of A11 is the draft of a protocol for the *ex-situ* conservation of the 5 target species, including germplasm collection, conservation, and analysis of their genetic variability. Germplasm collection will be carried out in the applicative stage at DSA3 Germplasm Bank (FAO ITA_363). In order to enhance the *ex-situ* conservation of the target species, an Apennine flowerbed in the Botanical Garden of Perugia University is being designed and constructed, which will host typical species from the various types of Apenninic semi-natural grasslands (Annex I Habitats 6110*, 6210, 6220*, 6230, 6510) and, among them, the same Annex II-IV target plant species occurring in Umbria. Besides these basic activities, A11 is also devoted to the selection of a list of "H-key" plant species with a critical role for grassland Annex I Habitats reinforcement.

At the moment, the field activities for populations analyses have been completed for all the five target *taxa*, and the data analyses are currently in progress. The first results are here presented. The Project's activities could already benefit from the support of citizen science and expert contributions, deriving e.g. from the Regional Section of the Orchidologists Association G.I.R.O.S., and the Carabinieri Biodiversity Department of Assisi (PG).

Action A11 will be concluded at the end of 2022 and will be followed by the practical implementation of the developed Action Plans, in the second phase of the Project, including activities of population reinforcement and contrast to the specifically detected threats and pressures.

Preliminary insights on the vegetation of the small natural lentic environments of Palermo province (Sicily)

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Inland small standing-water ecosystems act as preeminent hotspots for biodiversity although they are globally threatened. In Sicily – the largest Mediterranean island – these ecosystems are normally found in small depressions from the coastal area to the mountain belt, interspersed within different land use types. Indeed, they are under the control of a multiplicity of local environmental (e.g., exposure, altitude, shading, surrounding vegetation, hydroperiod, water supply) and anthropogenic (e.g., trampling, water withdrawals, reshaping of the banks) drivers. Complementing a recently published paper on the aquatic vegetation of the *Lemnetea* and *Potamogetonetea* classes in western Sicily, a new contribution is presented on the vegetation of the most representative natural lotic environments of the province of Palermo (including a complex areas close to the Tyrrhenian Sea). The survey is aimed at the phytosociological characterization of a set of residual biotopes with a point distribution, locally called "gurghi" o "vurghi", located in the hilly-mountainous areas of Palermo province, in particular in Palermo Mts. (Gorgo di Rebuttone), Trabia Mts. (Gorgo di Pizzo Selva a Mare), Bosco Granza (Lago Bomes), Bosco Ficuzza and Rocca Busambra area (Gorghi Lungo, Tondo and Marosa), Sicani Mts. (Gorghi Carcaci, Carcaciotto, Sant'Andrea and Piano Scala) and Madonie Mts. (Gorgo Pollicino). This preliminary study, including data on some key ecological parameters (e.g., conductivity, pH, nutrients in water and sediments), puts in evidence the presence of a rich diversified aquatic and wet vegetation, ascribed to four classes (*Lemnetea minoris, Potamogetonetea pectinati, Phragmito-Magnocaricetea* and *Isoëto-Nanojuncetea*), allowing the identification of two Annex I habitats: 3150 (Natural euthrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation) and 3170* (Mediterranean temporary ponds). In particular, the monitored sites are refuge sites for many taxa with a fragmented distribution in Sicily, among which the most relevant are: *Callitriche brutia*, *C. obtusangula*, *Glyceria plicata*, *Iris pseudacorus*, *Ranunculus aquatilis*, *R. peltatus*, *R. rionii* and *Schoenoplectus lacustris*. Other exceedingly rare taxa are: *Alopecurus aequalis*, *Ceratophyllum submersum*, *Oenanthe aquatica Sparganium erectum* and *Potamogeton pusillus*. The vegetation includes very peculiar phytocoenoses rather rare in Sicily and generally in the Mediterranean bioregion, such as the free-floating communities (ascribed to two different alliances *Lemnion minoris* and *Stratiotion*), rooted plant assemblages (all. *Nymphaeion albae, Potamogetonion, Ranunculion aquatilis* and *Ranunculion omiophyllo-hederacei*), marginal helophytic *consortia* (all. *Phragmition australis*, *Glycerio-Sparganion* and *Alopecuro-Glycerion spicatae*) in contact, along the littoral characterized by strong seasonal water level variations, with ephemeral coenoses of the *Isoëto-Nanojuncetea* class. This relative high vegetation diversity is probably mainly to be attributed to the wide ecological range of small-standing water ecosystems investigated, that includes both natural and semi-natural ecosystems, as well as different hydroperiods, situated in turn on a variety of geo-lithological substrates (limestones, quartzarenites and clays). Despite their small size, which makes them very sensitive environments, these biotopes represent a fundamental component of semi-natural and natural ecosystems, which require adequate protection and monitoring actions in the inland of the Province of Palermo, and more generally in Sicily and in the Mediterranean region.

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Effects of alien mammals on plant communities on Giglio island (Tuscan Archipelago): insight from the project LETSGO GIGLIO

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The project LETSGO GIGLIO "Less alien species in the Tuscan Archipelago: new actions to protect Giglio island habitats" is a Life Natura project co-funded by the European Commission (www.lifegogiglio.eu). The project sees the collaboration of the Tuscan Archipelago National Park, the Department of Biology of the University of Florence, and the Company NEMO srl, for different actions on Giglio island (Tuscan Archipelago) towards the conservation of habitats protected under Dir. 92/43/EEC, thanks to the reduction of important threat factors, mainly represented by invasive alien species. Indeed, among the project actions, one is focused on the eradication of the mouflon (*Ovis aries*) while another is focused on the local control and of the wild rabbit (*Oryctolagus cuniculus*). Both these species are considered alien to Italy and may pose serious threats to native ecosystems acting as invasive species [1], particularly in small islands ecosystems. Particularly, on Giglio, the presence of mouflon is considered potentially harmful for the Mediterranean shrublands and holm oak forests (hab. 9340 *Quercus ilex* and *Quercus rotundifolia* forests according to Dir. 92/43/EEC). Wild rabbit is a serious threat to plant diversity and especially for the species typical of Mediterranean annual grasslands (hab. 6220* Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea* according to Dir. 92/43/EEC). Within this contribution, we present the first results from the monitoring of the impacts of these two alien species on the habitats mentioned.

The impacts linked to mouflon were monitored towards the survey of twenty transects, randomly extracted in the western sector of the Island, carried out in holm oak woodland, tall scrub and low scrub/garrigue habitats. In each transect, all individuals of woody species were counted, recording any evidence of grazing according to a simple four-level impact assessment scale (absent, low, medium, and high), and a subdivision between adult individuals, shoots, and seedlings. For the assessment of wild rabbits, we surveyed five subplots in each of four transects, listing the species present in each plot and recording any sign of predation, and also assessing the effects on soil and plant community, again according to the above four-level impact assessment scale.

The results show a greater load of grazing by mouflons in the north-west of the island at the Franco Promontory (where the mouflons were originally introduced to the island) and in particular in holm oak forests and high scrub habitats. In both, the impact is important in particular for the *Quercus ilex* shoots, while in the more southern areas, where the presence of low scrub and garrigue is more significant, we found less impact on the vegetation. The data on wild rabbits transects show a generally medium–high impact on soil and plant communities. Moreover, some of the species typical of habitat 6220* showed a high rate of predation (for example *Brachypodium distachyon*, *Hypochaeris achyrophorus*, *Stipa capensis*, *Trifolium subterraneum*).

These results provide quite an important zero point for the monitoring of the effectiveness of the action that will be carried out to control these two alien mammals. In fact, the data highlight a potential impact on the renovation of the most evolved woody communities, due to mouflon grazing and confirm the impacts cited frequently in the literature on the plant communities linked to the presence of wild rabbits.

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Re-visiting historical seminatural grasslands at Pian Grande di Castelluccio di Norcia to assess patterns of changes in species composition and vegetation cartography update

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Most of grasslands present in Europe are the result of human activity (e.g. grazing and mowing), defined as secondary grasslands [1, 2], and are important hotspots of biodiversity. However, these ecosystems represent higlhy vulnerable systems due to the changes and intensifications in land use (e.g. abandonment of agricultural practices), and afforestation [3, 4]. In addition to anthropogenic activities, another factor that currently influences the maintenance and specific richness of secondary grasslands is climate change, which in the last 20 years in the Central Apennine has led to a strong reduction in the snow cover period and an increase in minimum annual temperature [5]. This has led to an increase in coverage or the appearance of drought and stress tolerant camephytic species together with a decrease in those more mesophilic, micro-thermophilic and competitive species [6, 7].

For the reasons mentioned above, it is important to understand the dynamics of vegetation. This study has the aim of understanding how the grassland communities currently present at the Pian Grande di Castelluccio di Norcia (Central Apennine), have evolved over the last 50 years. To evaluate these changes, an approach based on the review of historical plots associated with a map was performed, since this type of approach has proved particularly useful in the study of semi-natural grasslands, as reported in several studies [i.e. 8, 9]. The original plots were created by Pedrotti towards the end of the 1970s, associated with the Vegetation Map of the Pian Grande di Castelluccio di Norcia [10]. We revisited them and compared them with the new plots.

We proceeded as follow: 1) digitization of phytosociological surveys (for a total of 116 surveys divided into 9 tables); 2) digitization of the 1: 500 scale map of the Vegetation of Pian Grande di Castelluccio di Norcia in 1969; 3) cluster analysis with historical data; 4) nomenclatural updating of grassland species; 5) resampling of wetlands.

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Traditional vs Adaptive Multi-Paddock grazing in Mediterranean silvopastoral systems

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The project LIFE Regenerate (LIFE16 ENV/ES/000276) aims to improve biodiversity and ecosystem services in Mediterranean silvopastoral systems by applying the Adaptive Multi-Paddock (AMP) grazing management model. AMP is a rotational grazing system with high stocking rates for short periods and resting periods long enough to plant regrowth. The experimental hypothesis is that AMP management is more effective than traditional grazing systems for maintaining plant biodiversity and the ecosystem services it supports [1]. We show here some preliminary results concerning the effects of AMP on Pastoral Value (PV), a proxy for forage production and quality, one of the most relevant ecosystem services of grasslands.

The results were obtained at "Sas Bogadas", in an experimental site located in the Municipality of Santu Lussurgiu (Sardinia, Italy) at 350 m a.s.l. on permanent grasslands. Grazing animals were suckling cows cattle (Modicana breed). The paddocks were managed with electrified fences. The average stocking rate in the AMP and control areas (CON), were managed with rotational or continuous grazing, respectively, at an average stocking rate of 2.9 livestock units (LU) ha-1 from March to May (90 days). The vegetation surveys were carried out with the "point quadrat" method along permanent linear transects (50 m) at regular intervals (1 m) randomly located within each survey area in the AMP paddocks and the CON. Following the grazing animal rotation in the AMP paddocks, the measurements were repeated six times in different seasons: from spring 2018 (time 0) to spring 2021 (time 6). The percentage contribution of each species (CSP) was calculated by dividing the number of occurrences of each species in the transect by the total number of contacts in each line. The PV was assessed according to Daget and Poissonet [2;3]. A two factors ANOVA (grazing management by date) was performed to compare the PV of AMP vs CON. Preliminary results did not show significant differences between AMP and CON. Significant differences were observed between dates. The highest PV means were detected in spring 2020 (PV=47), the lowest in autumn 2018 (PV=33). This result is consistent with the temporal variability of Mediterranean pastures PV [4] in relation to the seasonal weather and the soil seed bank dynamics of annual species [5].

The hypothesis of higher effectiveness of AMP in providing ecosystem services was rejected on the basis of the obtained results on PV. However, this does not exclude that other aspects of the system that are being investigated by the Life Regenerate project, such as plant biodiversity, soil characteristics, forage and animal production might be significantly influenced by the AMP grazing management system.

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Freshwater habitat recording for strengthening nature conservation: the contribution of Plant Sociology to the UN Agenda 2030

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All freshwater waterbodies, permanent or temporary, from the biggest to the smallest with running or standing waters, play an essential role in ecosystem service delivery. Their conservation and sustainable management support life on earth from improving biodiversity, ensuring drinking water and climate change mitigation [1,2,3]. In 2018, the 4th report of the 92/43/EEC Habitat Directive ex-Art. 17 showed that the overall conservation status of freshwater habitats ranges from inadequate to bad inadequate in most EU member states in all biogeographical regions [4,5]. Therefore, sound policies, monitoring, and good management are essential, and restoration is also crucial. In this view, habitat recording is still mandatory because many gaps of knowledge remain. To systematically fill these gaps, the journal Plant Sociology in 2019 launched a dedicated section: New national and regional Annex I Habitat records [6]. To date, 25 are the contributions released for 70 new cells of the EEA 10 km x 10 km Reference grid, including 34 new occurrences in Natura 2000 Sites. Around 30% of the 25 contributions refers to freshwater habitats [6,7,8,9]. The new Plant Sociology section represents a coordinated and scientifically validated tool for collecting updated habitat distribution data and might be beneficial in correspondence of the 5th (2019-2024) and the 6th (2025-2030) six-year periodical Habitat reporting activities. The release of the 6th Habitat Directive report will collimate with the target year of the worldwide path opened by the United Nations to attain based the 17th Sustainable Development Goals (SDGs), where water is playing a pivotal role [10]. Therefore, let us combine our efforts recording habitats and contributing to the achievement of the UN Agenda 2030 SDGs.

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Influence of natural and anthropogenic factors on plant diversity in Mediterranean coastal landscapes: the case of Tuscany

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Coastal dunes provide fundamental ecosystem services for our well-being, including shore defence, water storage and purification, nutrient recycling and climate regulation. The maintenance of these services depends on the integrity of coastal plant communities, which play a key role in dune formation and stabilization. Understanding the drivers of dune plant diversity is thus essential for preserving coastal ecosystem functioning and services.

In the last decades, Mediterranean coastal landscapes have undergone strong urbanization with the consequent habitat and biodiversity loss. In this context, a multi-factorial analysis becomes crucial to identify the factors having the strongest impact on plant diversity.

By combining field-collected vegetation data (336 random plots) and remote sensing imagery, we analysed the influence of natural and anthropogenic factors on the coastal dune vegetation along the Tyrrhenian coasts (Tuscany, Italy). First, we used 20 cm resolution orthophotos to map natural and artificial land-cover classes across a 300 m wide coastal belt. Thus, we obtained a high-resolution land-cover map (1:2000) that comprised 1,575 spatial polygons belonging to 8 macro-categories: artificial, agricultural and afforestation (the latter category further divided into pine forests and mixed forests), woody habitats, semi-natural vegetation, herbaceous coastal habitat, coastal and inland wetland and, inland and marine waters. Then, we applied a rectangular buffer (100×300 m) on the land-cover map and extracted a set of landscape variables around each vegetation plot: raw number of land-cover classes, diversity of classes (Shannon), number of polygons and relative area for each land-cover class.

We used linear and generalized linear regression to model plant diversity (i.e. native species richness, Shannon and Simpson diversity of dune communities) as a function of the landscape variables. Also, we included the distance between each vegetation plot and the closest bathhouse in the models as a proxy of tourism intensity.

The most frequent land-cover classes were herbaceous coastal habitat (327 polygons) and maquis (241). Other frequent classes were pine forests (184 polygons), artificial areas (127) and wetlands (105).

Our preliminary results evidence that bathhouse negatively affected species richness. Similarly, plant diversity significantly decreases as the number of polygons of artificial increases, pointing to the negative effect of anthropogenic activities on dune vegetation. On the contrary, plant richness and diversity were positively affected by the relative area of herbaceous coastal habitat polygons, in particular by the upper beach vegetation, indicating that dune vegetation benefits from well-preserved coastal zonation. These first results indicate tourism industry and urbanization as the main drivers of habitat degradation in the analysed coastal environments.

The *Genista radiata*-dominated communities in Italy: diversity and classification

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Genista radiata is a dwarf/low orophilic shrub having a fundamentally South-European distribution. In Italy, it can be found in different ecological contexts, often giving rise to diversified coenoses, from heliophilous primary communities in limiting edaphic conditions, to secondary mantle shrublands, to coenoses of dynamic stages colonizing secondary grasslands. Due to its ecological plasticity, in the past literature *G. radiata* communities have been considered in local works sometimes as simple dynamic variants of grasslands aspects, sometimes as more or less stable shrublands, and this interpretation has changed over time. We therefore analyzed the coenological and ecological features of the Italian communities dominated or co-dominated by *G. radiata*, searching for the presence of floristic-sociological groups, allowing a sound and updated comprehensive classification from a syntaxonomical point of view. An Italian comprehensive data-set of 129 published + unpublished relevés in which *G. radiata* had relevant cover values has been investigated by means of multivariate analysis. The ecological requirements of the resulting groups were indirectly calculated by means of Ellenberg Indicator Values, and a chorological analysis was performed. The fidelity coefficient (*phi*) for the diagnostic species of each group was calculated. According to our analysis, nine different types of *G. radiata* communities were found to be present in Italy. Each group was characterized by means of its floristic, ecological and chorological components, and investigated as to its syntaxonomic aspects. This allowed to attribute the Italian *G. radiata* communities to nine different associations, four of which already existing and five proposed as new associations or as *stat. nov.* The classification at higher levels of these *syntaxa* is discussed and a comprehensive syntaxonomic scheme is proposed.

Critical interpretation of EuroVegChecklist with possible new syntaxonomic proposals for the Italian high-rank syntaxa

About the 4th edition of the International Code of Phytosociological Nomenclature

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The fourth edition of the International Code of Phytosociological Nomenclature (ICPN) prepared by the Steering Committee of the IAVS Working Group for Phytosociological Nomenclature was recently published and became effectively binding on 1 January 2021 [1].

Several amendments were introduced in the new edition. The presentation will discuss some of the most important of them, such as the introduction of autonym; the introduction of a conserved type to preserve a name; the introduction of a binding decision to solve controversial or singular cases; the automatic correction of the taxon names (name-giving taxa) used in the names of syntaxa in accordance with the International Code of Nomenclature for algae, fungi, and plants; the mutation of the name of a syntaxon in using other correct, alternative names for the name-giving taxa; the introduction of inadequate names resulting from corrections of names; the acceptance of electronic publications; and the mandatory use of the English or Latin terminology for syntaxonomic novelties.

1) Theurillat J.-P., Willner W., Fernández-González F., Bültmann H., Čarni A., Gigante D., Mucina L., Weber H. E., 2021. International Code of Phytosociological Nomenclature. 4th edition. *Applied Vegetation Science* 24: e12491.

Where does *Cratonerion* belong? An attempt to answer based on the tufa waterfalls in Croatia

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The aim of this presentation is to discuss the position of alliance *Cratoneurion commutati* Koch 1928 within European phytosociolgycal system [1] based on the comparison of two large areas with tufa forming vegetation dominated by bryophytes from different biogeographical regions of Croatia – the Plitvice Lakes (Alpine Biogeographical Region) and the Krka River (Mediterranean Biogeographical Region). The Plitvice lakes are system of 16 larger and several smaller lakes, separated with tufa barriers, which stretches along 8 km, representing the largest habitat of the tufa forming moos communities (*Cratoneurion commutati*) in Croatia and the whole Europe. The Krka River is a large karstic river with tufa barrages forming a complex system of interchanging fast and slow water flow, waterfalls and barrage lakes. Seven waterfall systems harbouring tufa forming bryophyte communities are situated along the 73 km of the river course before the mouth into the Adriatic Sea. Moss communities could be assigned partially to the *Cratoneurion commutati* and partially to the alliance *Adiantion* Br.-Bl. ex Horvatić 1934, but sharing large proportion of species. Comparison of floristic composition of communities form two biogeographic regions reveals high resemblance in main species as well as low proportion of species assigned as characteristic for the class *Montio-Cardaminetea* Br.-Bl. et Tx. ex Klika et Hadač 1944, where *Cratoneurion commutati* is placed. Therefore, it is proposed to place *Cratoneurion commutati* into the class *Adiantetea* Br.-Bl. et al. 1952 and to extend its area of distribution towards Continental and Alpine Biogeographical regions.

1) Mucina L., Bültmann H., Dierßen K., Theurillat J.-P., Raus Th., Čarni A., Šumberová K., Willner W., Dengler J., García R.G., Chytrý M., Hájek M., Di Pietro R., Iakushenko D., Pallas J., Daniëls F.J.A, Bergmeier E., Guerra A.S., Ermakov N., Valachovič M., Schaminée J.H.J., Lysenko T., Didukh Y.P., Pignatti S., Rodwell J.S., Capelo J., Weber H.E., Solomeshch A., Dimopoulos P., Aguiar C., Hennekens S.M., Tichý L. 2016. Vegetation of Europe: Hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities. *Applied Vegetation Science* 19 (Suppl. 1): 3-264.

Mowed meadows of the *Molinio-Arrhenatheretea* class in Central Italy

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The mowed meadows of the *Molinio-Arrhenatheretea* class occurring in Central Italy are currently referred to the following phytosociological alliances: *Ranunculo neapolitani-Arrhentatherion elatioris*; *Cynosurion cristati*; *Ranunculion velutini* [1]. The latter one of these alliances is included in the *Trifolio-Hordeetalia,* an order which exhibits an amphi-Adriatic distribution [2], and it is the alliance in which generally are classified the temporary flooded prairies of the karst basins of Central Apennines ranging between the upper Mesotemperate and Supratemperate thermotypes (according to Rivas-Martínez et al. classification [3]).

Several associations of mowed meadows were described for Peninsular Italy in the phytosociological literature, and although these have normally been classified in one or the other of the three aforementioned alliances, the floristic and ecological autonomy of these alliances has only been dealt with to a limited extent with detailed analyses. In fact, it is not rare to find plant communities exhibiting intermediate ecological features or partially overlapping floristic aspects between these three alliances, that lead them not very easily classifiable in a high-rank syntaxonomic framework.

In this paper, we carried out a research aimed to clarify the ecological, biogeographical and syntaxonomic position of the three alliances in issue using new unpublished data deriving from new field-work samplings performed in several areas of central Italy. The first results show that the syntaxonomic schemes adopted and mostly utilized at present are not always consistent with the particular and variegated floristic, ecological and biogeographical context of the Central Apennines.

1) Biondi, E. et al. 2014. Plant communities of Italy: The vegetation prodrome. Plant Biosystems, 148, 728–814.

2) Mucina, L., et al.. 2016. Vegetation of Europe: hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities. *Applied Vegetation Science* 19, suppl. 1: 3–264.

3) Rivas-Martínez S., Penas A., Diaz T.E. 2004. Bioclimatic Map of Europe. Leon cartographic Service, University of Leon.

Is the current syntaxonomic classification of the sub-Mediterranean oak-hornbeam thermophiles forests able to encompass the high coenological diversity of south-eastern Europe?

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In this paper the order *Fraxino orni-Ostryetalia* Jakucs 1959 [1] is repurposed for the thermophiles and basophiles *Ostrya carpinifolia* / *Quercus pubescens* – bush woods and for the thermophiles and slightly acidophilous *Quercus petraea* woods of the SE-Europe. This proposal is based on the high plant diversity of the concerned territories, characterized by a diverse evolution history in respect to Southern – Central Europe where instead the *Quercetalia pubescenti-petraeae* woods are at home. The Alpine range has in fact constituted a great spatial caesura between profoundly different temporal processes. The high number of *Ostrya carpinifolia* communities in the Southern Alps, Apennines and the Balkan Peninsula with important presences up to Anatolia [2] also highlight the great ecological amplitude of the hop-hornbeam. This species participates in the terminal phases of the dynamic processes which are absolutely original compared to the corresponding ones in Central Europe. Two suborders (*Fraxino orni-Ostryenalia* subord. nov. hoc loco and *Querco cerridis-Carpinenalia orientalis* stat. nov. hoc loco) within the order *Fraxino orni-Ostryetalia* are distinguished.

Also, the independence of the alliance *Cruciato glabrae-Quercion petraeae* [3] in respect to similar alliances occurring in Europe is highlighted and the two alliances *Cruciato glabrae-Quercion petraeae* and *Quercion pubescenti-petraeae* are compared.

1) Jakucs P, 1959. Über die ostbalkanischen Flieder-Buschwälder. *Acta Bot. Acad. Sci. Hung*., 5: 357-390.

2) Quézel P, Barbéro M, Akman Y, 1980. Contribution à l'étude de la végétation forestière d'Anatolie septentrionale. *Phytocoenologia*, 8(3/4): 365-519.

3) Poldini L, Sburlino G, Vidali M, 2017. New syntaxonomic contribution to the Vegetation Prodrome of Italy. *Plant Biosystems*, 151(6): 1111-1119.

Nomenclatural revision for the *Festuco hystricis-Ononidetea striatae* and *Rumici-Astragaletea siculi* in Italy

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The 'Eurovegchecklist' (EVC, Mucina et al. 2016) is considered the standard syntaxonomic classification of Europe. It introduced an important novelty by extending eastward the distribution area of the Iberian class *Festuco hystricis-Ononidetea striatae*, up to Italy. As a consequence, syntaxa previously classified in the *Rumici-Astragaletea siculi*, *Festuco-Brometea*, and even other classes, were therefore moved to the *Festuco hystricis-Ononidetea striatae*, originating complex syntaxonomic and nomenclatural relationships, with many new synonyms.

This paper aims to revise the nomenclature of the Italian syntaxa belonging to the *Festuco hystricis-Ononidetea striatae* and *Rumici-Astragaletea siculi* classes according to the EVC. Thirty-four names were revised, including four classes, ten orders, and twenty alliances. The nomenclature revision followed the 4th edition of International Code of Phytosociological Nomenclature (Theurillat et al. 2021).

Correct names, authors' citations, and possible causes of invalidity and illegitimacy were provided for all the syntaxon names. The major differences between our findings and what has already been reported in the EVC concerned six syntaxa (one class, two orders, and three alliances), which we considered as invalid whereas these were considered as validly published in the EVC. In addition, we provided a new replacement name for one alliance which turned out to be a superfluous name, whereas it was considered as legitimate in the EVC.

Finally, we found that the class *Armerio gracilis-Festucetea*, not included in the EVC, was validly published, and represents a later syntaxonomic synonym of the *Festuco hystricis-Ononidetea striatae*, while the order *Festuco-Seslerietalia nitidae*, previously considered invalid, is instead the earliest valid available name at this rank for the "submediterranean xeric calcicolous grasslands on skeletal soils of the Apennine Peninsula and the oro-mediterranean belt of Sicily" (ONO-03, Mucina et al. 2016).

A correct nomenclature is essential for the stability of the European vegetation classification, for further syntaxonomic advances, and allows a precise exchange of syntaxonomic information, syntaxonomy and nomenclature being two sides of the same coin.

1) Mucina L, Bültmann H, Dierßen K, Theurillat J-P, Raus T et al., 2016. Vegetation of Europe: hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities. Applied Vegetation Science 19 (Suppl. 1): 3–264..

2) Theurillat J-P, Willner W, Fernández-González F, Bültmann H, Čarni A, et al., 2021. International Code of Phytosociological Nomenclature. 4th edition. Applied Vegetation Science 24: e12491.

Free session

Investigating functional diversity and redundancy of Mediterranean high-mountain vegetation types in the Apennines

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Understanding species assembly rules is a long-standing issue that can be adequately addressed accounting of their functional role in the community. If two coexistent species are functionally similar, the loss of one of them does not alter ecosystem functioning. If instead, coexistent species are dissimilar and play different roles, their loss could dramatically alter ecosystem functioning and survival over time. High-mountain vegetation is shaped by the interplay of steep climatic gradients and fine scale topographical variability which give rise to a complex mosaic hosting high values of plant diversity. Understanding how such environmental features affects plant functional adaptations can contribute to better interpret vegetation response to global change. The present contribution sets out to analyze four high-mountain Mediterranean plant communities in terms of functional diversity and redundancy both at species and community level. We considered plant height which is related to processes of competition, and two leaf traits (leaf dry matter content and specific leaf area) as indicators of resource exploitation strategies.

We used georeferenced vegetation plots and field-measured plant functional traits for the dominant species of four widely spread and representative vegetation types of high-mountain central Apennines: *Leucopoa dimorpha* community growing on screes, *Sesleria juncifolia* community on steep slopes, *Plantago atrata* community on snowbeds and *Silene acaulis* community on ridges. At species level, we performed an indicator species analysis and we addressed how each indicator species is functionally similar to the co-existent ones. Then, we analyzed functional diversity (FD) and redundancy (FR) on each community using Rao's Quadratic Entropy and performing ANOVAs and Tukey Post-Test. Similarly, we calculated the community weighted mean (CWM) and we analyzed their variation across the four vegetation types by ANOVAs and Tukey Post-Test.

Our results suggest that on Mediterranean summits, community assemblage rules are specific for each plant trait and vary according with the considered plant community context (e.g. abiotic filters and biotic interaction). We registered higher redundancy values and lower functional diversity for plant height on snowbeds and ridges communities suggesting a climatic filter exerted by low temperatures. However, in snowbeds we found high FD and low FR for leaf traits, suggesting competitive processes related to soil nutrients use. Contrary, high FD for plant height and low for leaf traits on steep slopes grassland suggest competitive strategies for light assured by a long growing season. On screes vegetation FD and FR values depict random processes probably due to the substrate instability which prevents the development of stable plant communities.

With this work we contribute to increase the knowledge on community assembly rules across high-mountain habitats in the Mediterranean, offering new insights to envisage their vulnerability to global environmental changes.

Alpine shrub encroachment in the central Apennines: current patterns and temporal trends

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Since the end of the 2nd World War, European mountain areas have been increasingly abandoned, resulting in grazing declines and often in shrubs encroachment within alpine belts. Our study focuses on the Mediterranean alpine and subalpine belt (Central Apennines - Reatini, Duchessa and Ernici mountains) that are characterized by historical land use and summer water shortage that makes alpine vegetation particularly vulnerable to global changes. In this context, we aimed to describe current patterns and encroachment trends of dwarf shrubs: we obtained shrubs distribution and encroachment in the last ~60-yrs by mapping shrub patches on both satellite images (2012) and historical aerial photos (1954). We then related shrub distribution and encroachment trends to simultaneous influence of multiple environmental factors on a wide temporal scale (topography, productivity, grazing pressure, climate and snowmelt patterns).

Our results showing a significant dwarf shrub encroachment in the area, mainly by Juniperus communis var. saxatilis. Topological heterogeneity, as well as variation in fine-scale productivity, strongly shape shrub distribution and encroachment patterns, with an important modulating role of productivity on climatic effects. In particular, spatial distribution and encroachment are mainly negatively related to productivity, spring snow cover and summer temperature. Contrarily, dwarf shrubs spread in unproductive and infertile areas associated with high slope and curvature and early snowmelt time. In this way, dwarf shrub may benefit from open space. Surprisingly, our results suggest that variation in grazing pressure had no influence on the current dwarf-shrub distribution and encroachment.

Our results are consistent with previous observations of alpine shrubs encroachment worldwide. Moreover, we have obtained comprehensive results showing that the alpine and subalpine environmental fine-scale matrix may strongly shape the overall distribution and temporal trends.

1) Isla H Myers-Smith et al (2011) Shrub expansion in tundra ecosystems: dynamics, impacts and research priorities. http://dx.doi.org/10.1088/1748-9326/6/4/045509

2) Lionello, P. et al (2006). The Mediterranean climate: an overview of the main characteristics and issues. https://doi.org/10.1016/S1571-9197(06)80003-0

Pattern and drivers of plant beta diversity along an elevational gradient of Central Apennines – (Italy)

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The composition of plant communities is influenced by spatial, climatic and topographical drivers as well as by intrinsic dynamics of the communities (e.g. competition and facilitation). The differences among communities (beta diversity) are strongly influenced by spatial and environmental distances among sites. Distances among sites are negatively correlated with similarity among communities and this pattern is known as the distance-decay of similarity.

Based on plants presence absence data from 84 nested plots we investigated the drivers that affect plant beta diversity patterns along spatial, altitudinal, topographic, and climatic gradients through an elevational gradient in a Mediterranean mountain. The plots were collected in the Velino massif (Central Apennines – Italy), and the nested sizes ranged from 0.015 m x0.015 m to 16 m x16 m. The set of bioclimatic (air temperature, soil temperature and precipitation) and topographic variables were selected filtering out autocorrelated variables. Thus, for bioclimatic variables we selected: air annual mean temperature, air temperature annual range, soil annual mean temperature, annual precipitation, precipitation of driest quarter; for topographic variables: slope, elevation, and topographic wetness index. We calculated plant beta diversity using the Sørensen index for the plot sizes 0.50 m x 0.50 m, 2 m x 2 m and 16 m x 16 m. The distance-decay was investigated for the 3 plot sizes using as explanatory variables the spatial distance, the elevational distance and the environmental distance. All these patterns were modelled using generalized linear models (GLM). Finally, to investigate the patterns of plant beta diversity we used generalized dissimilarity modelling (GDM). According to GLM results, the patterns of beta diversity are better explained by elevational distance than spatial distance. The GDM showed that the main plant beta diversity predictors are geographical distance, soil annual mean temperature and air temperature annual range. In conclusion, this study has demonstrated that the differences in plant communities' composition between sites in the study area is mainly influenced by the elevational distance and differences in soil temperature.

Surveying roadsides: *Sorghum halepense*-dominated vegetation in peninsular Italy

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Sorghum halepense is a synanthropic cosmopolitan tall grass. It is a perennial, rhizomatous plant creating dense vegetatively- and sexually-reproduced communities. It disperses by water, wind, animals, and through impurities in grain and hay [1]. The species usually indicates habitat degradation, biodiversity reduction, physical disturbance, and modification of successional patterns on EU Natura 2000 habitats like "rivers with muddy banks with *Chenopodion rubri* p.p. and *Bidention* p.p. vegetation" (3270) and "hydrophilous tall herb fringe communities of plains and of the montane to alpine levels" (6430) [2].

Though roadside plant communities dominated by *Sorghum halepense* are very common in southern Europe, their phytosociological nature is scarcely studied. In summer 2020, we carried out 73 phytosociological relevés across peninsular Italy in the regions of Liguria, Tuscany, Latium, Campania, Basilicata, and Apulia. We analysed our data by means of a modified TWINSPAN classification and Non-metric Multidimensional Scaling to statistically compare our relevés to 64 from the Balkans ascribed to the association *Cynodonto-Sorghetum halepensis*, describing agricultural annual weed vegetation classified in the alliance *Spergulo arvensis-Erodion cicutariae* (syn. *Polygono-Chenopodion*), class *Stellarietea mediae* s.l., used in the past as a reference for some Italian *S. halepense*-dominated communities [3].

Our results show our vegetation type being very different from the communities of the association *Cynodonto-Sorghetum halepensis*. The Italian communities are strictly perennial, dominated by hemicryptophytes and geophytes, and are better classified in the alliance *Inulo viscosae-Agropyrion repentis*, class *Artemisietea vulgaris*, consistently with previous interpretations by other authors [3,4]. Chorologically, they show a lower occurrence of cosmopolitan elements and a higher presence of Mediterranean and archaeophyte species. Such findings allow us to propose the new association *Potentillo reptantis-Sorghetum halepensis*, including the two new subassociations *typicum* and *urticetosum dioicae* and a variant characterized by *Convolvulus sepium* and *Elymus repens* linked to agricultural aspects. According to the current knowledge, the *Potentillo reptantis-Sorghetum halepensis* occurs in Italy, Kosovo and Slovenia, but its potential distribution is much wider given the occurrence of a high number of cosmopolitan species.

Our study provides a baseline for the knowledge of plant communities possibly threating Natura 2000 habitats and a contribution to the knowledge of noxious agricultural weeds, in the perspective of defining appropriate management strategies [2]. More investigations are needed in the future to complete the understanding of this vegetation type at a broader scale.

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Morphological and chemical traits of *Cladonia* lichens respond to vegetation dynamics and other environmental factors in acidic dry grasslands

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Terricolous lichen communities in lowlands occur especially in open dry habitats, being limited to such habitats in heavily human-impacted areas. Such communities are often dominated by species of the genus *Cladonia*, which are very variable in functional traits like morphology (6 types), reproduction strategies (4 types) and secondary metabolites (11 types in the species considered here). In this work, we investigated traits-environment relationships considering vegetation dynamics, substrate pH, disturbance and climate.

A total of 122 plots were surveyed in 41 acidic dry grasslands in the western Po Plain (Northern Italy: Lombardia and Piemonte). Cover (%) of lichens, bryophytes and vascular plant species was recorded in each plot, together with substrate pH and cover of two main disturbance types: trampling and fecal pellets of the invasive lagomorph *Sylvilagus floridanus*. Climate data were retrieved by the database CHELSA. The cover (%) of the biological forms of the vascular plants were considered as a proxy of vegetation dynamics, considering that in dry grasslands therophytes dominate pioneer stages (also indicating ongoing vegetation dynamics due to disturbance in some cases), hemicryptophytes and geophytes dominate intermediate stages (indicating less active but still ongoing vegetation dynamics) and chamephytes and phanerophytes dominate mature stages, also indicating the passage from grassland to more developed vegetation types. The relationships between *Cladonia* traits and environmental variables were investigated by means of a model-based Fourth Corner Analysis.

Thallus morphology and metabolites responded to vegetation dynamics, substrate pH, disturbance, and climate, whereas reproduction strategies responded only to vegetation dynamics. Traits' correlations with vegetation dynamics elucidate their colonization patterns in open dry habitats or suggest biotic interactions with bryophytes and vascular plants; in addition, the correlations between vegetation dynamics and some metabolites can help in explaining the success of some widespread *Cladonia* species. Other correlations between metabolites and environmental factors support some interpretations on their ecological roles. Our results also stress the importance of understanding traits' relationships with climatic factors to alert towards trait-mediated reactions of lichens to the climate change.

Relationships among vascular plants, mosses and lichens in grasslands communities along elevational gradients

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Altitudinal gradients have been widely studied, especially on mountains, in order to investigate diversity patterns occurring among and within communities, on the basis of abiotic and biotic factors. Taking into account taxonomic diversity and functional diversity simultaneously is fundamental to shed light on the drivers that shape communities [3]. Moreover, for a better comprehension of the processes operating onto communities, it is critical to adopt a multi-taxa approach to adequately disentangle the role of abiotic and biotic effects on biodiversity [2]. Although vascular plants are the main group of organisms inhabiting grasslands, these habitats are important even for mosses and terricolous lichens, especially in a perspective of elevation gradient [1, 4]. For this reason, we decided to investigate how diversity of these three groups changes in grasslands along an elevational gradient.

We surveyed grassland communities along the elevation gradient (the last 800 m of elevation) of two study areas in Tuscany (Pania della Croce and Monte Prado). A total of 80 randomly placed quadrat plots of 2 x 2 m were used to assess vascular plants, mosses and lichens species abundance and sample their functional traits. A set of environmental variables were measured at plot level in order to characterize sites' microtopography and soil.

Preliminary analyses showed that the increase of species richness of mosses and lichens with elevation is mainly due to a decrease of vascular plants community (in particular coverage and height of vegetation) and not directly to altitude. Nevertheless, using other biodiversity indices (e.g. Rao index), we found weaker relationships between vascular plants and mosses and lichens communities. In order to take into account a wide set of possible relationships among different communities and environmental variables, we performed structural equation models (SEM). Our preliminary results obtained by SEMs showed that elevation is weaker in shaping vascular plant biodiversity compared to soil characteristics (i.e. N content or outcrops). Moreover, it was confirmed that the vascular plant community is the main driver that affects both taxonomic and functional diversity of mosses and lichens In particular, we found that it is the functional diversity of vascular communities that showed more effects on other communities compared to taxonomic one.

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Critical interpretation and new proposals for the Manual of European Union Habitats

A new challenge from Artificial Intelligence: Robotic European Union habitats monitoring

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The Habitat Directive 92/43/EEC requires periodic monitoring of habitat and species, which implies a considerable effort for the EU States. Indeed, monitoring is a complex task that requires high experience, detailed knowledge, and specific skills. For this reason, specialized human operators are nowadays the only ones able to perform this activity with the increasing support of supervised and semi-supervised tools (e.g. satellite or drone imagery). Robotics, which made tremendous advancements in recent years, could give further support. The challenge is to develop tools for repetitive and time-consuming activities in habitat monitoring.

At present, robots are not robust and efficient enough to survive in the real world and struggle to autonomously percept, interpret, and move on highly irregular, slipery, and unstructered environments, not to mention the ability to manage unexpected situations, contacts, and impacts.

As of January 2021, the H2020 Project "Natural Intelligence for Robotic Monitoring of Habitats - NI " (call H2020-ICT-2020-2, ICT-47-2020 "Research and Innovation boosting promising robotics applications") started with the aim to develop quadruped robots able to successfully and autonomously move in different habitat types. Specifically, dunes, grasslands, forests, and rocky alpine terrains, corresponding, respectively, to 2110/2120, 6210, 8110/8120 and 9110/9210 Annex I Habitats were selected as case studies. NI robots will be empowered by "natural intelligence", leveraging artificial cognition and articulated soft-robotics.

Considering the sampling approach already proposed and consolidated [1], we identified a set of items and parameters for each case study, including the physical environment, vegetation structure, and target species occurrence. For example, target species could be the species typical of the habitat [2], if already defined, species indicator of good habitat quality or habitat degradation. While the botanists proposed items and parameters, the robot's intelligence specialists evaluated how to train the robot to do the surveys. The first request was a collection of pictures and mini clips from different perspectives and in different meteorological and brightness conditions for each selected item and parameter.

Robots will probably never fully replace human operators in habitat monitoring; however, they might offer a valuable advantage for biodiversity conservation, effectively complementing the human operator's ecological, taxonomic and syntaxonomic skills.

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Drivers of temporal changes in Mediterranean coastal dune habitats

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Coastal dunes are fragile ecosystems of outstanding conservation value. Beyond hosting a rare and unique flora, they provide essential ecosystem services including coastal defense, groundwater storage and climate mitigation. Nevertheless, they appear among the most endangered ecosystems on Earth and especially in the Mediterranean, where several habitats have been recently classified as 'threatened'. In the last two decades, Mediterranean coastal dune vegetation of Central Italy experienced major taxonomic shifts consisting in species loss, high turnover and community simplification. Using data from a resurveying study, we investigated the drivers of recent (10–15 years) changes in 334 vegetation plots belonging to herbaceous dune habitats. We identified four metrics of vegetation change: i) plot status (plot vegetated at the time of the resurvey or not); ii) Jaccard's dissimilarity index and iii) its loss component; iv) absolute change in focal species richness. Using linear regression, we tested the influence of a set of potential drivers summarizing natural and historical anthropogenic disturbances, as well as changes in landscape configuration. Species richness, functional diversity and alien species richness at the time of the original survey were also included in the models to account for biotic mechanisms. Though with differences among models, our results indicate coastal erosion and landscape dissimilarity (i.e. change in the composition of land-cover classes over time) as the most important drivers of temporal change, followed by the amount of artificial land-cover historically present in the plot surroundings. Interestingly, functionally diverse communities located in areas experiencing an increase in psammophilous vegetation over time were able to mitigate the loss of focal species. Our analysis suggests that recent temporal changes in Mediterranean coastal dunes are driven by multiple processes acting at different spatial scales.

Remote sensing time series and Functional Principal Component Analysis: a new promising approach for habitats mapping and monitoring

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The phytosociological mapping plays a key role in defining habitats biodiversity management, monitoring, and conservation strategies (92/43/EEC Habitats Directive). The mapping of plant associations and habitats are particularly difficult if exclusively based on *in situ* observations, while is effective and accurate if combined with multi-temporal remotely sensed data (e.g. remote sensing time series) that capture the vegetation seasonality (seasonal variations of the spectral reflectance in relation to the different phenological stages of the vegetation).

Here we present a new methodological framework for the mapping and monitoring of plant associations and habitats. The methodology relies on the analysis of remote sensing time series (e.g. Landsat 8, Sentinel-2) with the Functional Principal Component Analysis (FPCA) - that is still rarely used in remote sensing and ecology - and supervised classification methods [1,2]. We evaluated the methodology in two different Special Conservation Areas (SACs) of Central Italy ("Monte Conero" - IT5320007 and "Gola di Frasassi" - IT5320003).

The methodology enabled accurate mapping of several forest, shrub and grassland plant associations identified on the ground by the phytosociological approach. We obtained an overall accuracy of 82.3% for the "Gola di Frasassi" area and 87.5% for the "Monte Conero" one. The overall accuracy was much higher than that of the previous maps derived from the photointerpretation of domain experts ("traditional" method).

The results highlighted that: (i) plant associations, together with their own typical floristic composition, have different and unique remote sensing phenological behaviours (seasonal spectral profile); (ii) the main seasonal phenological variations (identified by FPCA) are effective spatial predictors to obtain accurate plant associations and habitat maps; (iii) mapping effort is reduced over traditional approach owing to the high data availability offered by satellites.

The proposed approach is useful and promising for habitat mapping and monitoring, as it can contribute to produce periodically detailed vegetation-based habitat maps that reflect the "current" status of vegetation and habitats, also supporting the analyses of phytosociologists and decisions of land managers.

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Application of the Directive 92/43/EEC: the Monitoring Plan of the Campania Region

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According to the DPR 357/1997 and its later amendments, the monitoring ex art. 7 (surveillance, ex art 11 of the Directive 92/43/EEC, hereafter HD) is mandatory for each Administrative Region. Even if the results of this activity are used to prepare the report ex art 17 of the HD, the main goal of the monitoring is to assess the effectiveness of the applied conservation measure in maintaining or improving the conservation status of habitat, plant and animal species listed in the HD annexes.

In this juridical contest, the cost of the monitoring activities is in charge of the regional authority. The economic evaluation of a Monitoring Plan is crucial to define its economic sustainability and the appropriate political decisions to supply the required funds. A monitoring plan at regional level is therefore a complex tool that must consider both scientific topics and practical issues such as to quantify the required economic and labour resources to perform it.

The Monitoring plan of the Campania Region (MPCam) is annexed to the DD n. 12/2018, and it is based on its concrete feasibility both in economical and practical terms. Moreover, the MPCam considers the low level of knowledge of Natura 2000 network at regional level.

From the technical point of view, the MPCam includes all the monitoring methods of terrestrial and freshwater habitats, plant and animal species in the same document. The PMCam is drawn according to the national guidelines (1, 2, 3). Improvements and additional information are provided to facilitate management of monitoring actions for both Contracting Entities (Campania Region and/or Natura 2000 Site management authority) and contractors.

The main goals of the PMCam are:

To assess the conservation status of habitat and species listed in Annexes **within** the Natura 2000 network as well as on the efficiency of the applied conservation measures;
to update conservation objectives and Standard Data Forms of Natura 2000 sites;
to assess the conservation status of habitat and species listed in Annexes **outside** the Natura 2000 network;
to provide data for Reporting ex art. 17

According to these goals, priorities in monitoring activities are selected and two different levels of monitoring activities are planned. The first level deals with actions referred to all species and habitat at regional level, to fill the existing gaps of knowledge and to gather the "zero" point of monitoring. The second level of monitoring includes actions carried out considering the specific needs in terms of conservation objectives of the Natura 2000 Site, following the adaptive management approach.

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Open issues on the identification and effective indicators definition of Habitats

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The aim of this presentation is to open a debate about the general concepts of the habitat types identification and consequently on the definition and measurement of effective indicators to them related. Habitats Directive (Council Directive 92/43/EEC, hereafter 'HD') identified a group of Corine Biotopes units [1] that European Countries considered important to be protected. Despite in HD the majority of habitat types are defined by vegetation communities, ecological research provides alternative definitions. Recently Fahrig [2] has proposed the 'habitat patch concept', based on the assumption that habitat patch boundaries contain and delimit biological populations and community and it raises the problem of the uncertainty in how to delineate and measure ecologically relevant habitat patches. Particularly this aspect still plays a pivotal role in the active debate between 'categorical' and 'dynamic' habitat maps (see [3]). In this normative (HD) and academic context we should consider the habitat types as concept that can address different types of vegetation, hosting several types of organisms. Here we would like to raise the question if the habitat types listed in Annex I could be considered as 'empty boxes', to be filled with relevant and standardized features and parameters (included communities) for conservation planning goals. Although a National Interpretation Manual [4], two reports for assessing the conservation status of habitat types [5,6], and a national handbook for habitat monitoring [7] have been produced in Italy, some issues about habitat definition still remain, and the selection of plant communities belonging to them is a harder task. A shared and univocal method for habitat identification and for the measurement of effective indicators, along with their threshold values, is now particularly needed in the challenging context of the National Monitoring Plan.

When we look at the habitats it should be taken into account: taxonomy of the occurring plants and animals, plant traits, vegetation structure, functions, species of conservation concern, etc. Habitats Directive is the major useful tool for nature protection. We should remember the European context in which the HD was built, in 1992, the state of art at that time and the legally binding initiatives which inspired and share information among all involved specialists in order to really have a conservation active perspective.

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Critical interpretation of habitat 6210 "semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)" in Calabria

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Among grassland habitats of community interest, 6210 is one of the most widespread in Italy, including xeric grasslands on calcareous substrates occurring along all Apennines. These coenoses are much diversified at local level and floristically characterized by numerous endemics, but all of them can be referred to *Festuco-Brometea* class. However, its full denomination specifies some ecological and phytosociological limits for definition of the habitat, putting in evidence the calcareous nature of the substrates and narrowing the field to plant associations framed in *Festuco-Brometalia*.

The general description of the habitat mentions steppic or subcontinental grasslands (*Festucetalia valesiacae*) and the grasslands of more oceanic and sub-Mediterranean regions (*Brometalia erecti*), including types belonging to *Mesobromion* and *Xerobromion*.

Mountains of Sila, Serre Vibonesi and Aspromonte, characterized by granite and metamorphic outcrops, present very complex grassland habitats mosaic, influenced by morphology, soil quality and hydric gradient that cause frequent alternation between habitat types richer in water (*Nardus stricta* communities and grasslands of *Molinio-Arrhenatheretea*) and dry habitats.

Xeric grassland vegetation of Calabrian siliceous mountains, often dominated by chamephytes, is referred to *Anthemidetalia calabricae,* endemic order recently included in *Festuco-Brometea* class .

To this order is referred the orophilous cushion-like vegetation such as *Astragaletum calabrici* e *Plantagini serpentinae-Chamaecytisetum spinescentis*, included in a subtype of habitat 4090. The same order also includes coenoses dominated by hemicryptophytes, especially grasses, that should be correctly incorporated in grasslands habitat types. Initially, this kind of grasslands have been excluded by 6210 habitat type, because of their ecological and phytosociological differences. However, these peculiar vegetation deserves to be included in a habitat type of community interest, and 6210 is the closest typology for the ecological role in the evolutionary dynamics and for its belonging to *Festuco-Brometea*.

These interpretation problems caused differences in reporting habitat 6210 in Calabria, raising formal problems partially solved during the last habitat-monitoring program started in Calabria in 2018. However, a shared review is still needed, also considering an updating of the European and the Italian Interpretation Manual of 92/43 EEC Directive Habitat.

A new habitat of the shady wet cliffs (Adiantetea capilli-veneris) of the Mediterranean region

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In the framework of the monitoring activities related to the drafting of the 4th Habitat Directive report, some gaps were highlighted as regards the classification of some rocky habitats hosting rare or endemic species [1]. In the light of this lack, we propose the inclusion in Annex I of the Habitat Directive, of a new habitat "Shady wet cliffs (*Adiantetea capilli-veneris*)". This shady and wet habitat, with high edaphic humidity, includes the dripping cliffs/walls of the Mediterranean areas characterized by chomophytic and chasmophytic vegetation referred to the *Adiantetea capilli-veneris* class. In the Mediterranean area this class includes one order and three alliances; in particular, the alliance *Adiantion capilli-veneris* groups plant communities dominated by *Adiantum capillus-veneris* and particularly rich in bryophytes that grow on siliceous or calcareous dripping cliffs; the second one, *Pinguiculion longifoliae* includes a relict herb-rich chomophytic vegetation of shaded and water-splashed habitats, dominated by *Pinguicula* sp. pl., while the *Polysticho setiferi-Phyllitidion scolopendri* groups the fern-rich communities of damp walls and narrow and shady ravines. This shady, wet and rocky habitat type is characterized by the occurrence of ferns (*Adiantum capillus-veneris, Blechnum spicant, Pteris vittata, Pteris cretica, Osmunda regalis, Phyllitis scolopendrium, Woodwardia radicans*), mosses (*Eucladium verticillatum, Didymodon tophaceus, Pellia endiviifolia, Conocephalum conicum, Palustriella commutata*), and vascular plants (*Urtica rupestris, Cymbalaria pubescens, Hypericum hircinum, Hypericum androsaemum, Samolus valerandi, Blackstonia perfoliata, Pinguicula hirtiflora, Pinguicula poldinii*). Such vegetation type is typically found under the Mediterranean macrobioclimate and, occasionally, under the sub-Mediterranean variant of the temperate macrobioclimate [2]. In Italy, it has been observed in the southern part of the peninsula and in the main islands, as well as in coastal and sub-coastal areas of the central-northern part of the country [3-7]. These fern-rich plant communities, on thicker and water-rich soils, often come into catenal contact with the bryophytic phytocoenoses of the *Cratoneurion commutati* alliance in the Habitat 7220* "Petrifying springs with formation of tuffs (Cratoneurion)". Previously, the *Adiantetea capilli-veneris* plant communities were referred to the 8310 or 7220* Habitats.

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Critical interpretation of some Sicilian habitats in the Directive 92/43 EEC and new proposals for for their reappraisal in the Manual of European Union Habitats

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It is well known that the classification of Mediterranean habitats mentioned by the EU-Directive 92/43 (henceforth: habitat directive) presents quite some critical issues, which affect the correct designation of conservation targets by the bodies called to Nature protection. The need to "interpret" the habitats of the Directive determines some intrinsic contradictions: on the one hand, the recognition of almost ubiquitous and all-encompassing habitats, as in the case of habitat 6220; on the other hand, the territorial "stretching" of some habitats to include some outstanding biotopes which, otherwise, would be completely devoid of protection measures, as in the case of habitat 5430.

Taking the Sicilian territory as a case study, we will present a conceptual and methodological framework for addressing some of the shortcomings of the Habitats Directive in the recognition of biotopes that deserve to be protected at the regional scale. Particular attention will be paid to highlighting that a correct delimitation of the habitats should rely on a phytosociological approach and consider the phytogeographical background driving the species assemblages and adaptive responses of biocoenoses. The combination of a phytosociological and phytogeographical approach to habitat recognition could finally resolve the conundrum of habitat identification and, through appropriate additions, could finally resolve also some current ambiguities of the Habitats Directive.

Need for a revision of the habitats listed in Directive 92/43 EEC to safeguard the biodiversity of southern Italy

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The European Directive 92/43 (HD), main legislative instrument of European nature conservation policy, lists habitats and species of Community interest, for whose conservation Special Areas of Conservation (SAC) are designated. Habitat identification and classification are two crucial steps time to pursue objectives aimed at addressing the loss of biodiversity. Although the "Manual of European Union Habitats Eur 28" details the main characteristics of habitats of Community interest, uncertainties remain when trying to identify habitat types in the field. National manuals as the "Italian Interpretation Manual of the habitat " have tried to address this issue in relation to the Habitats already reported in the European Interpretation manual, without however amended or proposed to add new habitats to the initial list, despite the increased knowledge provided from studies concerning vegetation and ecosystem carried out in the last two decades.

Habitats of Community interest should synthesize the ecological and biogeographical diversity of a territory in order to identify biotopes that otherwise, would be left without conservation measures. However, numerous gaps remain in the identification and interpretation of some European habitats, especially as regards those occurring in Mediterranean bioclimates. Hypotheses of a partial revision of the interpretation manual have often been advanced during the numerous national and international seminars and workshops held on the Habitat Directive.

In this work, a group of researchers from different Italian universities selected a list of plant communities characterizing southern Italy, which show great floristic, ecological and/or biogeographical relevance such that they can be proposed as new habitats for Annex I of the Habitat Directive. Moreover, the differences in the ecological context or in the list of diagnostic species that led to the proposal of new habitats or possible similarities that may suggest inclusions with already existing habitats were highlighted in the paper. Among the plant communities investigated there are: "Mediterranean helophytic sub-halophilous meadows"; "Stream environments of the southern Apennines and Sicily; "Helophytic communities of flowing and well oxygenated waters"; "Mediterranean dripping cliffs (*Adiantion*)"; "Mediterranean and sub-Mediterranean dwarf garrigues with presence of rare and/or endemic species"; "Mofettes and mud volcanoes"; "Acidophilous oak woods with *Quercus petraea* subsp. *austrotyrrhenica* of the southern Apennines and Sicily".

The coenological characterization of these possible new habitats was based on a solid backbone of phytosociological relevés. In fact, the phytosociological approach proved to be the most reliable in solving ambiguities in the interpretation of Directive habitats and therefore the most widely used for habitat identification and classification. The proposals for new habitat types can be an important tool to refine the effectiveness of the Habitats Directive and fully safeguard biotopes of high natural value in southern Italy not fully considered, at present, in their ecological, biogeographical and landscape importance.

Proposal for additions to Annex I of Directive 92/43/EEC with new habitats worthy of conservation for central Italy

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The Habitats Directive represents the most important and effective tool of the European Union for the protection of biodiversity in the European territory.

However, due to the insufficient naturalistic knowledge at the time of joining the Directive and a probable initial underestimation of the European project by Italy, Annex I is far from including the entire heritage of Italian habitats worthy of protection.

In the light of this awareness, and thanks to the enormous effort carried out by naturalists in applying the Directive itself, a deeper level of knowledge has now been reached and the scientific community is now able to take a step forward for the acknowledgment of species, habitats, or more generally ecosystems deserving conservation interest. Therefore, proposals have been formulated for the inclusion of new habitats for Italy, pending the granting of the possibility of integrating Annex I by the European Commission.

To this end, for central Italy, the description sheets of several habitats of great phytogeographic interest, or important for conservation purposes, here defined as “neglected”, have been prepared as they are currently excluded from any safeguard tools at the European level. These habitats will be here presented and discussed.

Neglected vegetation in Sardinia: what possibilities to be considered in Annex I of the Habitats Directive?

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The Habitats Directive (92/43/EEC) is, together with the Birds Directive, the primary legislation concerning nature conservation policy in Europe. Being first adopted in 1992, it went through several updates and corrections, mainly to the annexes, including Annex I, which provides a list of the habitats of EU Interest. The habitat types of community interest fall into at least one of these criteria: are in danger of disappearance in their natural range; have a small natural range due to their regression or because of their intrinsically restricted distribution area; present outstanding examples of typical characteristics of one or more of the eleven European biogeographical regions. While many criticisms remain in interpreting the habitat types, pragmatic solutions have been agreed upon, particularly in biogeographical seminars. However, some interesting habitats do not appear in Annex I, but probably fall within the definition of "habitats of community interest" [1].

This research presents a preliminary list of relevant vegetation types in Sardinia challenging to place in Annex I of the Habitat Directive. So far, we have identified more than 30 vegetation types with characteristics that make them potentially eligible as "habitats of community interest". As expected, given the high number of endemic species that characterize Sardinian flora and, more in general, biological communities, most neglected vegetation types have a small natural range due to the intrinsically restricted area of the characteristic species.

Considering that the option of establishing new habitat types is generally rejected, we formulated some proposals to include them in already listed habitats by modifying the diagnostic phrase to broaden the current habitat definition or introducing well-defined subtypes. However, this procedure may not always be possible.

Unless new types are included in Annex I, the rarest and most fragile habitats identified will remain neglected and, therefore, unsuitable to be properly managed and conserved.

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